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CROWN-GALL OF APPLE AND PEACH
WITH NOTES ON THE BIOLOGY
OF BACTERIUM TUMEFACIENS

DONALD REDDICK and V. B. STEWART

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CROWN-GALL OF APPLE AND PEACH WITH NOTES ON THE BIOLOGY OF BACTERIUM TUMEFACIENS

DONALD REDDICK AND V. B. STEWART

THE CROWN-GALL DISEASE

The crown-gall disease, caused by *Bacterium tumefaciens* Smith & Townsend,¹ occurs on a great variety of plants and over a wide geographical range. It has been noted particularly in fruit culture from practically every fruit district in the United States, and the very general opinion expressed in the literature on this subject is that the disease is a dangerous one and its introduction into a planting is greatly to be feared.

The evidence bearing on the economic importance of the disease is largely observational and few experimental data are at hand to show its exact importance. The observational data are fully summarized by Smith, Brown, and Townsend² and need not be repeated here. In general, it may be concluded from these authors' digest of the literature that apples are not seriously affected but that peaches and many other plants are. These writers are inclined, however, to include apples (page 197 of the bulletin cited) in the list of plants that should be inspected for crown-gall, and to recommend rejection of trees showing galls or hairy root. They suggest that even if apple trees are not materially affected by crown-gall, the distribution of trees bearing galls will serve to spread the disease to new localities and to other hosts which are more susceptible and which may be injured thereby. Neither point seems to be well taken when one considers (1) the very wide distribution of the disease at the present time, and (2) that the apple constitutes a relatively permanent crop which is not interplanted except for a few years and then preferably with cultivated crops such as potatoes, beans, corn, and the like, that is, plants which do not develop the disease under natural conditions.

In a more recent publication, Erwin F. Smith³ states that "when death results it is not due to the direct action of the bacteria, but to

¹Attention is called to the fact that this organism is named *Bacterium tumefaciens* in conformity with the nomenclature of Erwin Smith, which is in common use among plant pathologists. According to the nomenclature commonly followed by bacteriologists, however (see *Bergey's Manual of Determinative Bacteriology*, 1923), this organism would be called *Phytomonas tumefaciens*.

²Smith, Erwin F., Brown, Nellie A., and Townsend, C. O. Crown-gall of plants: its cause and remedy. U. S. Dept. Agr., Bur. Plant Ind. Bul. 213:1-215. 1911.

³Smith, Erwin F. Further evidence that crown gall of plants is cancer. *Science* 43:871-889. 1916. (The quotation cited is on page 876.)

other factors, *e.g.*, nutritional defects, and secondary parasitisms," and it is to be expected, therefore, that climatic conditions, soil conditions, and various other factors may enter to cause even greater variations in different regions than would result if only the one complication were involved. For this reason, regional tests must be made to determine the destructiveness of the disease for any particular set of conditions.

In this connection it is to be recalled that some years ago F. C. Stewart⁴ stated before a convention of fruit growers that "in New York, at least, apple crown gall is an unimportant disease." Stewart cites the C. H. Stuart orchard at Newark, New York, as an example. It has been objected that C. H. Stuart was engaged in the nursery business at the time when the orchard was set (the inference being that he was therefore not disinterested), and that apparently no healthy trees were set for comparison. The former fact practically assures that the trees really had crown-gall disease, and the latter is a natural mistake sometimes made by others than merely practical men.

The controversy concerning the number of trees originally set in the Stuart orchard, and particularly the question as to whether one hundred of the original trees died, possibly from crown-gall, led one of the writers (R) to visit the orchard. The following facts were either ascertained from E. V. Pierson (the present owner and a son-in-law of C. H. Stuart), or determined by personal observation. The orchard is one and a half miles directly north of Newark on Main Street. It is on the right-hand side and a little back from the road, and is permanently marked by a large stone some three feet in diameter which lies at the southwest corner. The exact limitations of the original planting of galled trees cannot be determined. There are more than a thousand trees in the orchard, all apparently of the same age and of the same general appearance. The block, therefore, constitutes a satisfactory experiment, because at least as many gall-free trees were used as trees bearing galls. The number of galled trees planted originally is of little consequence, but Mr. Stuart's statement to F. C. Stewart may be accepted as the more likely number, namely, 500 trees. The galled trees in particular constitute a mixed lot of varieties. Baldwin, Greening, Sutton, and Ben Davis were recognized, and others are present. The remainder of the orchard seems to be somewhat mixed, also. The experiment indicates that, to date, crown-gall has done no material damage. Allowing for the numerous varieties set indiscriminately, the orchard is pronounced "average" by W. H. Chandler, Professor of Pomology at Cornell University. Trees have died here and there and have been replaced. Excepting for a wet area which scarcely could have been included in the block of galled trees, the number of missing trees is not greater in one area than in another.

⁴ Stewart, F. C. Interesting facts about crown gall of apple and peach. West. New York Hort. Soc. Proc. 53:97-98. 1908.

Recently, experimental data have been published on crown-gall experiments with apples, from the States of Iowa⁵ and Montana.⁶ The experiments were planned and executed on a large scale. In Montana it appears that while there was no noticeable effect on the vigor of the trees, nevertheless the root development of galled trees was not good, and it is thought that this would have become apparent when the trees began to bear heavy crops. In Iowa numerous growth data were recorded, and these show without exception that galled trees did not grow so fast as did trees free from gall. It should be noted, in this connection, that the method employed was one which has not yet received general indorsement by horticulturists.

An objection to all the experiments reported, including the one about to be recorded, is that the real test comes only with the production of fruit (because the trees are grown for the fruit they bear, not for the wood they produce). A well-planned experiment to determine the effect of crown-gall should extend well into or through the life of the plant. This would be a very long time for apple trees, but could be done relatively easily with peaches.

A proper interpretation of any of the crown-gall experiments thus far reported is rendered difficult by the fact that the experimental trees used have consisted of a miscellaneous collection for which there are no data as to original source, particularly as to the exact character and origin of the stock on which the trees were grown. The Iowa experiments illustrate this very well. One of the conclusions of Greene and Melhus is that Wealthy is more susceptible to crown-gall than is Jonathan. It is difficult to understand how this can be, since the varieties were grafted on seedling stock and an examination of the illustrations indicates that the galls are confined almost entirely to the stocks. It thus becomes necessary to assume an influence of scion upon stock which is not yet admitted by horticulturists. Under the circumstances it may be assumed with equal probability that the conditions of the experiment were such that a large variable factor was not brought under control. The Iowa experiment is further complicated by the fact that the plot of land in which the trees were planted had grown nursery stock some of which was affected with crown-gall, and that the plot is so located that it, or at least a part of it, received the wash from adjacent affected trees. Furthermore, the report does not state whether the trees were planted in such a way as to eliminate variations in soil and in growth conditions. It must be remembered in this connection that in average orchard planting the chance of infection after the trees are permanently set is very small.

⁵ Greene, Laurenz, and Melhus, I. E. The effect of crown gall upon a young apple orchard. Iowa Agr. Exp. Sta. Research bul. 50:145-176. 1919.

⁶ Swingle, D. B., and Morris, H. E. Crown-gall injury in the orchard. Montana Agr. Exp. Sta. Bul. 121:123-139. 1918.

The crown-gall disease seems to have been much more prevalent in New York some fifteen or twenty years ago than it is at the present time. There was much more agitation about the disease at that time, but this may be accounted for in part by the fact that inspection service for San José scale was being instituted and enforced, and that this inspection involved also examination for and rejection of trees having crown-gall. Aside from this, however, one of the writers (S), who was interested in diseases of nursery trees, recalls that in 1909 the fields in one large nursery from which apple trees had been dug were thickly strewn with trees that had been rejected at digging time because of crown-gall.⁷ It was this condition, in part, that led to the experiments herein reported. But in 1910, when trees were sought for the experiments, very few were to be found and there was some difficulty in procuring the necessary stock. This condition has prevailed in subsequent years. One factor in nursery management may have contributed to this desirable condition, namely, that there has been an increasing tendency on the part of the nurserymen to grow trees in rotation with farm crops, thus allowing for the death of *Bacterium tumefaciens* in the soil or on plant parts. Another factor which may be involved is that most apple trees in New York are budded on French stock. One of the writers (S)⁸ has expressed the opinion that French-grown stock is less susceptible to crown-gall than is American-grown stock, and it seems obvious that the practice of budding in the field, which is the common practice in New York, gives less opportunity for widespread infection than does that of bench grafting.

PLAN OF THE CROWN-GALL EXPERIMENT

In order to determine, if possible, the importance of crown-gall on apple and peach trees under the conditions existing at Ithaca, New York, an experiment was planned, the details of which were as follows:

The land for the experiment lay in a low field which had been in grass for a number of years previously. There are hills on all sides, but there is suitable drainage so that the soil is never too wet for good growth. The soil is a good loam, running out into stony loam on the side where the rows are marked A in figure 1. The soil is suitable for the growth of both apples and peaches, but the location is unsuited for peaches. Peaches are grown successfully a few miles from Ithaca, but there is little chance of securing crops in the immediate vicinity, chiefly because of low temperature in the winter. This was not fully realized at the beginning of the experiment.

The land was ploughed and cultivated each year and a sown cover crop usually was employed.

⁷ It is likely, though, that some of these trees bore galls produced by an aphid (*Schizoneura lanigera*), and this is the opinion expressed by one large nurseryman.

⁸ Stewart, V. B. Exclusion legislation and fruit tree production. *Phytopath.* 8:360-364. 1918. (The citation refers to page 362.)

THE EXPERIMENT WITH APPLES

Apple trees, of several varieties, bearing evident lesions of crown-gall were procured in the autumn of 1910. On April 20, 1911, photographs were made of the trees⁹ and the trees were set in the garden. On May 6, healthy trees were procured, photographs were made, and the trees were interspersed with the diseased trees as shown in the accompanying plan (figure 1). All the trees were two years from the bud and were on imported French stock. Practically all of them, except for the galls, would

	1	2	3	4	5	6	7	8	9
A	S	We	S	We	S	We	S	We	S
B	We	TO	We	TO	We	TO	Wa	TO	Wa
C	B	Wa	B	Wa	B	A	B	Wa	K
D	Wa	WR	Wa	WR	Wa	K	WR	K	K

FIGURE 1. PLAN OF THE APPLE CROWN-GALL EXPERIMENT

Each character represents a tree and indicates the name of the variety according to the following key: A, Alexander; B, Baldwin; K, Tompkins King; S, Northern Spy; TO, Twenty Ounce; Wa, Wagner; We, Wealthy; WR, Wolf River. Bold-face letters represent galled trees; light-face letters represent healthy trees

have been graded as best-quality trees. The notable exception is tree C-6, variety Alexander, which was small in diameter and bore a very large gall at the crown.

The trees were pruned very lightly from year to year, and in all cases the pruning consisted in the entire removal of undesirable limbs or branches. No heading-back was done.

A record of the general appearance of the trees was made twice each year, always without notes of the previous condition. For the most part the records are normal and may be tabulated without comment. One tree, C-3, was girdled by mice in the winter of 1913-14. A renewal developed but was winterkilled the following winter. The tree was removed on May 28, 1915, when it was found that the galls had enlarged appreciably (figure 2). The record of this tree previous to injury is shown in table 1.

The records for the apple trees are given in table 1. Before examining the records or deriving any conclusion, the reader should have in mind a number of items. (1) It is now evident that the experiment was not planned on a large enough scale to give the best results, and particularly there were not enough healthy trees planted for comparison. This was not an oversight on the part of those planning the experiment, but rather

⁹ The photographs are on file in the Department of Plant Pathology at Cornell University under the number 5727. None is reproduced here because the negatives are uniformly poor and suitable reproductions cannot be made. Camera and plates were tested in order that uniformly good photographs might be obtained without waiting to develop the negatives. When all negatives were found to be uniformly bad, it appeared probable that the shutter of the camera had been tampered with in the interim. The original negatives show the location and size of the galls very readily, and they proved most useful when the trees finally were removed.

was due to space limitations. (2) The varieties employed in the test were so numerous and the growth habits so different that comparisons between varieties would lead to error. On the other hand, the number of trees of any one variety was scarcely large enough to allow for satisfactory comparisons. (3) The yield of the trees was expected to give quantitative data. The trees had only just come into bearing, and so these data were not obtainable at the time when, of necessity, the experiment was terminated. It is not likely that the data would have been of sufficient



FIGURE 2. BALDWIN TREE C-3

The galls had increased somewhat in size, but there was no indication that they had interfered with the development of the tree

extent to be very reliable. (4) The apple-tree borer (*Saperda candida*) proved a great pest. Sometimes as many as six larvae were found in a single tree. If these larvae are removed, little injury will follow; but if one or two are missed—and this apparently is almost inevitable—great damage may be wrought within a few weeks. Most of the fluctuations in general appearance of trees from year to year, without question, are attributable to this borer. (5) Frost, rabbits, mice, and other fortuitous circumstances reduced the size of some trees so that, with the small numbers involved, it did not seem worth while at the end even to weigh the trunks and the crowns, although this could have been done very easily.

TABLE 1. ANNUAL RECORD OF GROWTH AND DEVELOPMENT OF HEALTHY APPLE TREES AND OF TREES AFFECTED WITH CROWN-GALL

(The trees were set in the spring of 1911 and records were made from 1912 to 1919 inclusive. The final record was made on May 20, 1920. In examining the trees for general condition and appearance, four classes were recognized: e, excellent; g, good; f, fair; p, poor. Healthy trees are designated by an asterisk)

Variety	Location	General condition of growth for the respective seasons								Condition of roots at digging time
		1912	1913	1914	1915	1916	1917	1918	1919	
Northern Spy..	A-1	p	p	f	g	f	f	f	e	g. No gall
Northern Spy..	*A-3	f	g	e	e	e	e	e	e	e. No gall
Northern Spy..	A-5	g	g	e	e	e	e	e	e	e. No gall
Northern Spy..	A-7	f	g	e	e	e	e	e	e	f. Hard gall at crown, size of a liter flask
Northern Spy..	A-9	g	g	e	e	e	e	e	e	g. No gall
Wealthy.....	A-2	f	g	g	g	g	g	g	e	g. Small galls on one large root
Wealthy.....	A-4	g	g	e	e	e	e	e	e	g. Two small hard galls at crown; small galls on two roots with hairy root
Wealthy.....	*A-6	f	g	e	e	e	e	e	e	g. No gall
Wealthy.....	A-8	g	g	e	e	e	e	e	e	e. No gall
Wealthy.....	B-1	e	g	g	g	g	g	g	e	e. No gall
Wealthy.....	B-3	e	g	e	g	1				
Wealthy.....	B-5	f	f	f	f	f	f	f	f	e. One hard gall (egg) on trunk; smaller galls on several roots
Twenty Ounce..	B-2	e	e	e	e	e	e	e	e	e. No gall
Twenty Ounce..	*B-4	f	g	g	e	e	e	e	e	e. No gall
Twenty Ounce..	B-6	e	g	e	e	e	e	e	e	Broken off at crown
Twenty Ounce..	B-8	g	g	....	e	e	e	e	e	g. No gall
Wagner.....	*B-7	f	g	e	e	e	e	e	e	g. No gall
Wagner.....	B-9	f	g	....	g	e	g	e	e	g. No gall
Wagner.....	C-2	g	g	e	e	e	e	e	e	e. No gall
Wagner.....	C-4	f	g	e	g	g	g	g	e	g. Remnant of hard gall in crown; small galls (egg) on two roots
Wagner.....	C-8	g	g	f	f	g	f	g	f	g. Hard gall (egg) in crown and on one root; small gall on one root
Wagner.....	D-1	g	g	g	e	e	e	e	e	g. No gall
Wagner.....	D-3	e	e	e	e	e	e	e	e	g. No gall
Wagner.....	D-5	g	g	e	e	e	e	e	e	g. One small (metastatic?), recent, hard gall on trunk above ground
Baldwin.....	C-1	g	g	e	e	e	e	e	e	e. No gall
Baldwin.....	C-3	g	g	2	....	....	....	....	....	....
Baldwin.....	*C-5	e	e	e	e	e	e	e	e	g. No gall

¹ Girdled by borer; removed October 11, 1916; gall in crown 8 centimeters in diameter.

² Girdled by mice; removed May 28, 1915; gall enlarged. (See figure 2.)

TABLE 1 (concluded)

Variety	Location	General condition of growth for the respective seasons								Condition of roots at digging time
		1912	1913	1914	1915	1916	1917	1918	1919	
Baldwin.....	C-7	g	g	g	g	g	g	g	f	g. No gall
King.....	C-9	e	g	e	e	e	e	e	e	g. Hard gall (egg) at surface of ground
King.....	D-6	g	e	e	e	e	e	e	e	g. No gall
King.....	D-8	e	g	e	e	e	e	e	e	e. No gall
King.....	*D-9	f	g	e	e	e	e	e	e	g. No gall
Wolf River.....	D-2	e	e	e	e	e	e	e	e	e. Doubtful galls on a few small roots
Wolf River.....	D-4	e	e	e	e	e	e	e	e	e. Small gall (egg) in crown
Wolf River.....	*D-7	e	e	e	e	e	e	e	e	e. No gall; stock enlarged (natural?)
Alexander.....	C-6	e	e	e	e	e	e	e	e	e. Stock enlarged on one side; hard gall present

The trees were removed on May 24, 1920. About two-thirds of them were pulled by hitching a team directly to them; the remainder were pulled with blocks. There was not the least indication that gall-free trees pulled more easily than those originally bearing galls. One tree, B-6, broke off at the surface of the ground, but this seems to have been due to weakening from borers and to the large size of the roots.

On examining the roots it could not be detected, from their appearance, size, or length, that there was any difference between the roots of galled trees and those of trees free from galls. The most surprising thing revealed by examination of the roots was that in many instances the original galls had disappeared completely. This was true in practically all cases in which the original tree had a long rootstock and the gall was located near the base of the stock. All the main roots issued from the stock near the surface of the ground, due perhaps to the nature of the subsoil. In most cases in which the gall was located on a lateral root, both root and gall had disappeared, but the same disappearance of original roots was noted in healthy trees also.

Summary for the apple experiment

The data in table 1 may be summarized in a few words. In no case is there indication that the presence of crown-gall on the roots of these apple trees interfered in any way with growth. The galls had largely

disappeared, and judging by this test the crown-gall disease on apples seems, in this locality, to be chiefly a matter of concern to the nurseryman.

Even in the nursery it is not certain that the disease is of great consequence for apples. It will be noted that most of the trees used in the test were of a size to be graded first-class. Galled nursery trees have been seen that were short and very small in diameter, and the natural inference is that the presence of the disease accounted for the size of the tree. It is to be remembered, however, that trees of small caliper are not uncommon in the nursery even when no disease is present. Tree C-6 of the experiment is of this sort, and its behaviour when planted in the orchard is of particular interest. Two companion trees of C-6 were rejected for the experiment because their dwarfed condition obviously made them unfair to the test. One of the writers (R) planted these two trees in deep sandy loam on private land. Both trees have made excellent growth, and as they were top-worked to early-maturing varieties both have borne crops of fruit. One tree was removed in 1922 to make way for a building. There was no evidence of the original gall or of subsequent infection. The other tree is larger than some others that were set in the immediate vicinity two years earlier.

In connection with the outcome of this experiment the experience of a well-known horticulturist is of interest. The following extract is taken from an article by C. A. Green, for many years editor of *Green's Fruit Grower*. The article appeared in the issue of that journal for May, 1912. The orchard mentioned in the article is located twelve miles southwest of Rochester, New York, and is of special interest because it is in the main apple belt of western New York.

Here is something that I want to call particular attention to. There is much said in these days about root gall on apple trees. At the time I planted this orchard but little was known about root gall. As I planted the trees with my own hands I noticed that occasionally a tree had a knotty excrescence on the roots which I now would recognize as root gall, and which is now regarded as infectious and fatal to the growth or welfare of the trees. Here is an interesting point which I desire to allude to: after growing for over thirty years and bearing fruit abundantly for over fifteen years, every tree in this orchard is healthy and one tree is as productive as another, and yet a number of these trees were infested with root gall. If the views of the experiment station are correct, the trees I planted thirty years ago, which were then affected with root gall, should long ago have perished or should have shown some signs of disease. That the trees are now all healthy and productive, teaches me that we have something yet to learn about root gall on apple trees.

THE EXPERIMENT WITH PEACHES

In the spring of 1911 a quantity of peach trees bearing evident lesions of crown-gall were procured from New York nurserymen. On April 6, 1911, photographs were made and the trees were set in the diseased garden as indicated in figure 3. Healthy trees were obtained in a separate shipment. The healthy trees were prepared for planting by one man, who used all antiseptic precautions. They were planted before the general lot of

infected trees, in order to avoid any contamination. All the trees were one year from the bud and were on peach stock. They were interplanted in the block of apples so that the whole block was on the quincunx plan with trees ten feet apart in the rows.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
B	B		B		B		B		B		B		B		B		B	B
C	B	B	B	B	C	C	C	C	C	C	C	C	C	E	C	C	C	C
D	C		C		C		C		C		E		C		C		C	C
E	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
F	E		E		E		E		E		E		E		E		E	E
G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
H	F		F		F		F		F		F		F		F		F	B

FIGURE 3. PLAN OF THE PEACH CROWN-GALL EXPERIMENT

Each character represents a tree and indicates the name of the variety according to the following key: *B*, Belle of Georgia; *C*, Carman; *E*, Elberta; *F*, Foster. Bold-face letters represent galled trees; light-face letters represent healthy trees

A great many of the trees failed to start growth when set, with the result that twenty-eight of the original ninety-eight affected trees were removed the first year. All of the affected trees of the variety Foster succumbed early. This may not be significant, because the original source and the treatment of these trees are not definitely known. From the high percentage of failures the first summer, it would appear that the crown-gall disease may be a factor in securing a good stand. This could be determined readily, but, unfortunately for the experiment, the crown-gall disease has been very scarce on peaches as well as on apples in New York nurseries since 1910, and doubtless for the same reason.

The winter of 1911-12 was severe, and winter sun-scald was abundant not only in the experimental block but throughout western New York. The loss from winter injury might be ascribed conveniently to a weakened condition of the trees due to the presence of crown-gall. The record shows, however, that 53 per cent of the healthy trees showed this injury, whereas only 20 per cent of the diseased trees were injured in this way. Furthermore, the winter of 1910-11 also was exceedingly severe for fruit trees of all kinds. Nurserymen generally were called on to replace many of the trees set in the spring of 1911. One firm alone replaced 20,000 peach trees out of a season's business of perhaps 300,000 trees. This may mean that two or three times the number replaced actually died, since, as a rule, not many persons demand replacement. For the most part the injury to the experimental trees occurred above the snow line, so that new growth started below the frost canker and above the point of union of scion with stock. Even when the renewal came from below the union, the tree was allowed to stand, since the development of the galls should be approximately the same.

In subsequent years many of the trees made excellent growth, as is shown in table 2, but each winter the temperature was low enough to kill fruit buds or else the buds were forced by a period of warm weather in late winter and then killed by frost.

The larvae of a borer (*Sanninoidea exitiosa*) gained entrance to a number of the trees in the late summer of 1913. As they were not noted until the following year, the number of trees showing effects of borer injury in 1914 is relatively large. The foliage of affected trees was slightly yellow (off color), was often somewhat rolled upward, and in some cases showed a marked tinge of red on the margins. Some of the borer channels extended far into the roots, and practically all of the trees removed on September 1, 1915, were injured primarily by borers. In some cases frost cankers were present, but these probably followed as a result of poor growth or immature wood consequent to borer injury.

Results of the peach experiment

From time to time the trees that were crowding, and especially those that were in poor condition, were removed. It was thus determined that borers were chiefly blamable for the poor appearance of certain trees, and that for the most part the galls had disappeared entirely. In many cases the position of the original gall could be determined only with difficulty or not at all. Usually the position could be determined by the occurrence on the stock of an area having the appearance of a healed wound (Plate II).

No crop of fruit was obtained during the course of the experiment, and so the only record is on the general appearance of the trees and the condition of the roots at digging time. The condition of the trees from year to year is shown in table 2. The same general reservations mentioned for the apples (page 7) apply in the case of the peaches, although the exact reason for the reservation is not the same in every instance.

The trees still living in the spring of 1918 were pulled. Unfortunately they were removed without warning and were not left in their regular order. An attempt was made to compare the leafless trees with previous growth records, but there was so much uncertainty about this that it was abandoned. Examinations of the pulled trees bore out the condition indicated in the table, namely, that most of the galls had disappeared.

The most interesting outcome of the experiment is that no peach trees died from the effects of crown-gall, and, so far as can be determined, the disease did not affect the growth of the trees to any appreciable extent. For the most part, galls either disappeared or were relatively small and insignificant. In a few cases the whole stock of the tree seems to have been enlarged, but even in such cases there was no indication, from the general appearance and growth of the tree, that any injury had been done.

TABLE 2. ANNUAL RECORD OF GROWTH AND DEVELOPMENT OF HEALTHY PEACH TREES AND OF TREES AFFECTED WITH CROWN-GALL

(The trees were set in the spring of 1911 and records were made from 1912 to 1917 inclusive. The final record was made on May 20, 1918. In examining the trees for general condition and appearance, four classes were recognized: *e*, excellent; *g*, good; *f*, fair; *p*, poor. Healthy trees are designated by an asterisk)

Variety	Location	1911 Oct. 3	1912 Oct. 12	1913 Sept. 6	1914 Sept. 14	1915 Sept. 14	1916 Sept. 11	1917 Sept. 25
Belle of Georgia	A- 1	.....	.....¹	.....	.....	.....	.....	.....
Belle of Georgia	A- 2	.....	<i>f</i>	<i>f</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>f</i>
Belle of Georgia	A- 3	Dead ²	.....	.....	.....	.....	.....	.....
Belle of Georgia	A- 4	.....	<i>g</i>	<i>g</i>	<i>f</i>	<i>p</i> ⁴	.....	.....
Belle of Georgia	*A- 5	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	*A- 6	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A- 7	.....	<i>e</i> ³	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A- 8	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A- 9	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A-10	.....	<i>e</i> ³	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A-11	.....	<i>f</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i> ⁵	.....
Belle of Georgia	A-12	Dead ²	.....	.....	.....	.....	.....	.....
Belle of Georgia	A-13	.....	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A-14	.....	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	A-15	.....	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>
Belle of Georgia	A-16	.....	<i>g</i> ²	<i>g</i>	<i>g</i>	<i>g</i>	<i>f</i> ⁶	.....
Belle of Georgia	A-17	Dead ²	.....	.....	.....	.....	.....	.....
Belle of Georgia	A-18	.....	<i>e</i> ³	<i>f</i>	<i>f</i>	<i>f</i> ⁷	.....	.....
Belle of Georgia	B- 1	.....	<i>e</i> ³	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i> ⁸	.....
Belle of Georgia	B- 2	.....	<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>
Belle of Georgia	*B- 3	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>	<i>g</i>
Belle of Georgia	*B- 4	.....	<i>e</i>	<i>g</i>	<i>e</i>	<i>e</i>	<i>e</i> ⁹	.....
Belle of Georgia	B- 5	.....	<i>e</i> ³	<i>g</i>	<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>
Belle of Georgia	B- 6	Dead ²	.....	.....	.....	.....	.....	.....
Belle of Georgia	B- 7	.....	<i>g</i>	<i>g</i>	<i>e</i>	<i>g</i>	<i>g</i>	<i>e</i>
Belle of Georgia	B- 8	Dead ¹	.....	.....	.....	.....	.....	.....
Belle of Georgia	B- 9	.....	<i>e</i>	<i>g</i>	<i>e</i>	<i>g</i>	<i>e</i>	<i>e</i>
Belle of Georgia	B-10	Dead ²	.....	.....	.....	.....	.....	.....
Belle of Georgia	H-10	.....	<i>e</i>	<i>e</i>	<i>e</i>	<i>f</i>	<i>g</i> ¹⁰	.....
Belle of Georgia	C- 1	.....	.....¹	.....	.....	.....	.....	.....
Belle of Georgia	C- 2	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>g</i>	<i>f</i>
Belle of Georgia	C- 3	.....	<i>e</i>	<i>g</i>	<i>e</i>	<i>e</i>	<i>g</i>	<i>g</i>
Belle of Georgia	C- 4	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>	<i>e</i>
Carman	*C- 5	.....	<i>e</i>	<i>g</i>	<i>g</i>	<i>e</i>	<i>e</i>	<i>g</i>
Carman	C- 7	Dead ²	.....	.....	.....	.....	.....	.....
Carman	C- 8	.....	<i>p</i> ³	<i>g</i>	<i>g</i>	<i>f</i> ¹¹	.....	.....

¹ Did not survive the winter.

² Failed to grow, or a few weak shoots pushed and then died.

³ Girdled by frost; a new shoot developed from below the snow line.

⁴ Removed September 1, 1915; winter injury; gall inactive, small.

⁵ Removed October 11, 1916; crowding; good roots; crown considerably enlarged; several small galls.

⁶ Removed October 11, 1916; roots fair; one small gall in crown; severe borer injury.

⁷ Removed September 1, 1915; winter injury; gall disappeared.

⁸ Removed October 11, 1916; excellent roots; large galls on crown; one gall 2 centimeters in diameter on one root.

⁹ Removed September 11, 1916; excellent roots; no galls.

¹⁰ Removed September 11, 1916; root system fair; crown somewhat enlarged but gall practically disappeared.

¹¹ Removed September 1, 1915; severe borer injury; gall disappeared.

TABLE 2 (continued)

Variety	Loca- tion	1911 Oct. 3	1912 Oct. 12	1913 Sept. 6	1914 Sept. 14	1915 Sept. 14	1916 Sept. 11	1917 Sept. 25
Carman.....	C- 9	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	C-10	.....	f	g	f	g	g	g
Carman.....	C-11	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	C-12	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	C-13	.....	g	g	f	e	e	e
Carman.....	C-15	.....	g	g	f	f ¹²	.....	.....
Carman.....	C-16	.....	e	g	g	g ¹³	.....	.....
Carman.....	C-17	.....	e	e	e	e	e	e
Carman.....	C-18	.....	f	g	p ¹⁴	p ¹⁵	.....	.....
Carman.....	D- 1	.....	e	e	e	e	e ¹⁶	.....
Carman.....	D- 2	.....	g	g	e	g	e	e
Carman.....	D- 3	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	D- 4	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	D- 5	.....	Dead ¹	.....	.....	.....	.....	.....
Carman.....	D- 7	.....	e	e	e	e	e	e
Carman.....	D- 8	.....	f	p ¹⁴	p	p	.....¹⁸	.....
Carman.....	D- 9	.....	g	g	g	e	e	e
Carman.....	D-10	.....	p ¹⁹	g	.....²⁰	.....	.....	.....
Carman.....	E- 1	.....	g	g	e	g	e	f
Carman.....	E- 2	.....	g	e	e	e	e	e
Carman.....	E- 3	.....	p ³	g	e	e	e ²¹	.....
Carman.....	E- 4	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	E- 5	.....	e	e	e	e	g ²²	.....
Carman.....	E- 6	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	E- 7	.....	e	e	e	e	e	e
Carman.....	E- 8	.....	e	g	p	p	p ²³	.....
Carman.....	E- 9	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	E-10	.....	g ³	e	e	e	e	g
Carman.....	*E-11	.....	g	e	g	e	e	e
Carman.....	*E-12	.....	e	e	e	e	e	e
Carman.....	E-13	.....	e	e	e	e	e	e
Carman.....	E-14	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	E-15	Dead ²	.....	.....	.....	.....	.....	.....
Carman.....	E-16	.....	g	f	p ¹⁴	f ²⁴	.....	.....
Carman.....	E-17	.....	e	g	g	f ²⁵	.....	.....
Carman.....	E-18	.....	g	g	g	e	e	e
Elberta.....	*C- 6	.....	g	g	g	g	e	g

¹² Removed September 1, 1915; severe borer injury; gall disappeared; two galls on roots; hairy root above crown.

¹³ Removed September 1, 1915; original gall disappeared; three galls (walnut) on one root.

¹⁴ Borer injury.

¹⁵ Removed September 1, 1915; original gall disappeared; one gall 1 centimeter in diameter on one root.

¹⁶ Removed October 11, 1916; gall disappeared; large tree, large root system.

¹⁷ Removed October 11, 1916; root crown in bad condition, evidently from gall but complicated by severe borer injury; three small galls on roots.

¹⁸ Missing, no record; severe borer injury previously.

¹⁹ Injured by plow.

²⁰ Dead July 1, 1914; no record.

²¹ Removed October 11, 1916; borer injury; several small galls.

²² Removed October 11, 1916; borer injury severe; galls disappeared.

²³ Roots fair; three small galls and indications of hairy root.

²⁴ Removed September 1, 1915; original gall disappeared; one gall 1 centimeter in diameter on one root.

²⁵ Removed September 1, 1915; borer injury; gall disappeared; indication of hairy root.

TABLE 2 (concluded)

Variety	Location	1911 Oct. 3	1912 Oct. 12	1913 Sept. 6	1914 Sept. 14	1915 Sept. 14	1916 Sept. 11	1917 Sept. 25
Elberta.....	C-14	.....	f ³	g	g	g	g ²⁶	.....
Elberta.....	D- 6	.....	f ³	g	f	g	g ¹⁷	.....
Elberta.....	F- 1	.....	g	f	p ²⁷	.....	.....	.....
Elberta.....	F- 2	.....	g	g	e	e	e	e
Elberta.....	F- 3	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	F- 4	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	F- 5	.....	f	f	f	f ²⁸	.....	.....
Elberta.....	F- 6	.....	e ³	g	e	e	e	e
Elberta.....	F- 7	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	F- 8	.....	e	g	e	f ²⁹	.....	.....
Elberta.....	F- 9	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	F-10	.....	g	g	g	f	f	f
Elberta.....	G- 1	.....	f	f	e	g	g	e
Elberta.....	G- 2	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	G- 3	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	G- 4	.....	e	e	g	e	e	e
Elberta.....	G- 5	.....	e	e	g	g	e	e
Elberta.....	G- 6	.....	e	e	g	e	e	e
Elberta.....	G- 7	.....	g	e	e	e	g	e
Elberta.....	G- 8	.....	e	e	g	e	g	*f
Elberta.....	G- 9	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	G-10	.....	g ³	g	f	g	f ³⁰	.....
Elberta.....	*G-11	.....	g ³	f	p ¹⁴	p ³¹	.....	.....
Elberta.....	*G-12	.....	g ³	g	g	f	p ³²	.....
Elberta.....	G-13	.....	e	g	g	g	e	e
Elberta.....	G-14	.....	g ³	g	p ¹⁴	f	p ³³	.....
Elberta.....	G-15	.....	g ³	g	g	g	e	e
Elberta.....	G-16	.....	g	g	g	f	e	e
Elberta.....	G-17	.....	e	g	f	f	e	e
Elberta.....	G-18	.....	g	f	g	f	g ³⁴	.....
Elberta.....	H- 8	Dead ²	.....	.....	.....	.....	.....	.....
Elberta.....	H- 9	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	H- 1	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	H- 2	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	H- 3	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	H- 4	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	H- 5	Dead ²	.....	.....	.....	.....	.....	.....
Foster.....	*H- 6	.....	e ³	g	g	f	g ³⁵	.....
Foster.....	*H- 7	.....	e	e	e	e	e	e

²⁶ Removed October 11, 1916; no record.

²⁷ Removed July 1, 1914; poor location and practically dead.

²⁸ Removed September 1, 1915; frost injury; gall disappeared.

²⁹ Removed September 1, 1915; injured by frost and borers; old gall not apparent.

³⁰ Removed September 11, 1916; borer injury; roots good; large galls, 6 to 7 centimeters in diameter, on crown and roots.

³¹ Removed September 1, 1915; injured by borers and frost; practically dead.

³² Removed September 11, 1916; severe borer injury; no galls.

³³ Removed September 11, 1916; borer injury severe; roots small; three small galls.

³⁴ Removed September 11, 1916; borer injury severe; one small gall.

³⁵ Removed September 11, 1916; recovering from severe borer injury; no galls.

Row A
Trees 1 to 4,
and 10, 7,
8, 9

Row A
Trees 11 to 18

Row E
Trees 1, 2,
and 5 to 10

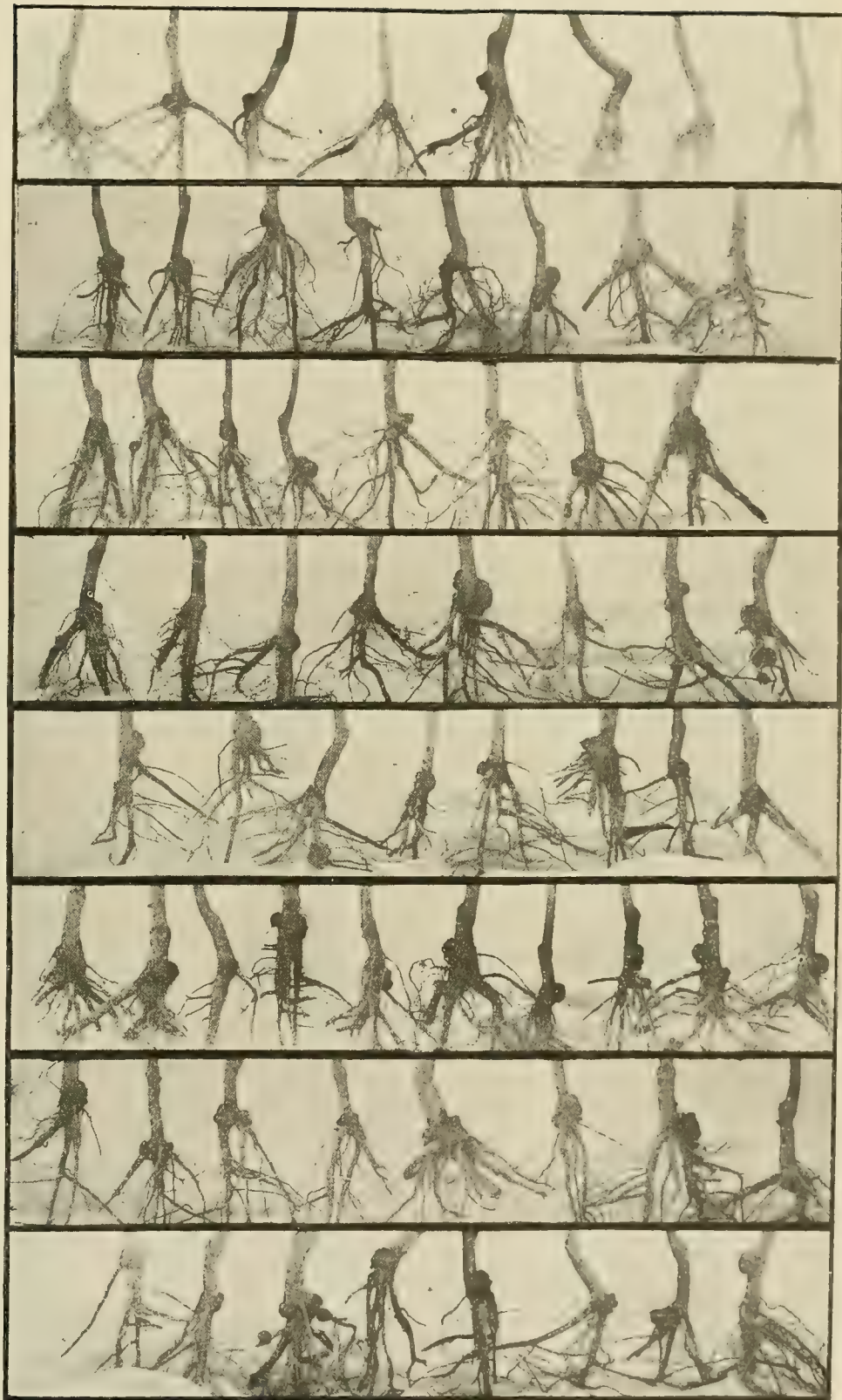
Row C
Trees 1 to 4
and 7 to 10

Row C
Trees 11 to 18

Row D
Trees 1 to 10

Row F
Trees 1 to 5
and 8 to 10

Row G
Trees 18 to 13,
10, and 9



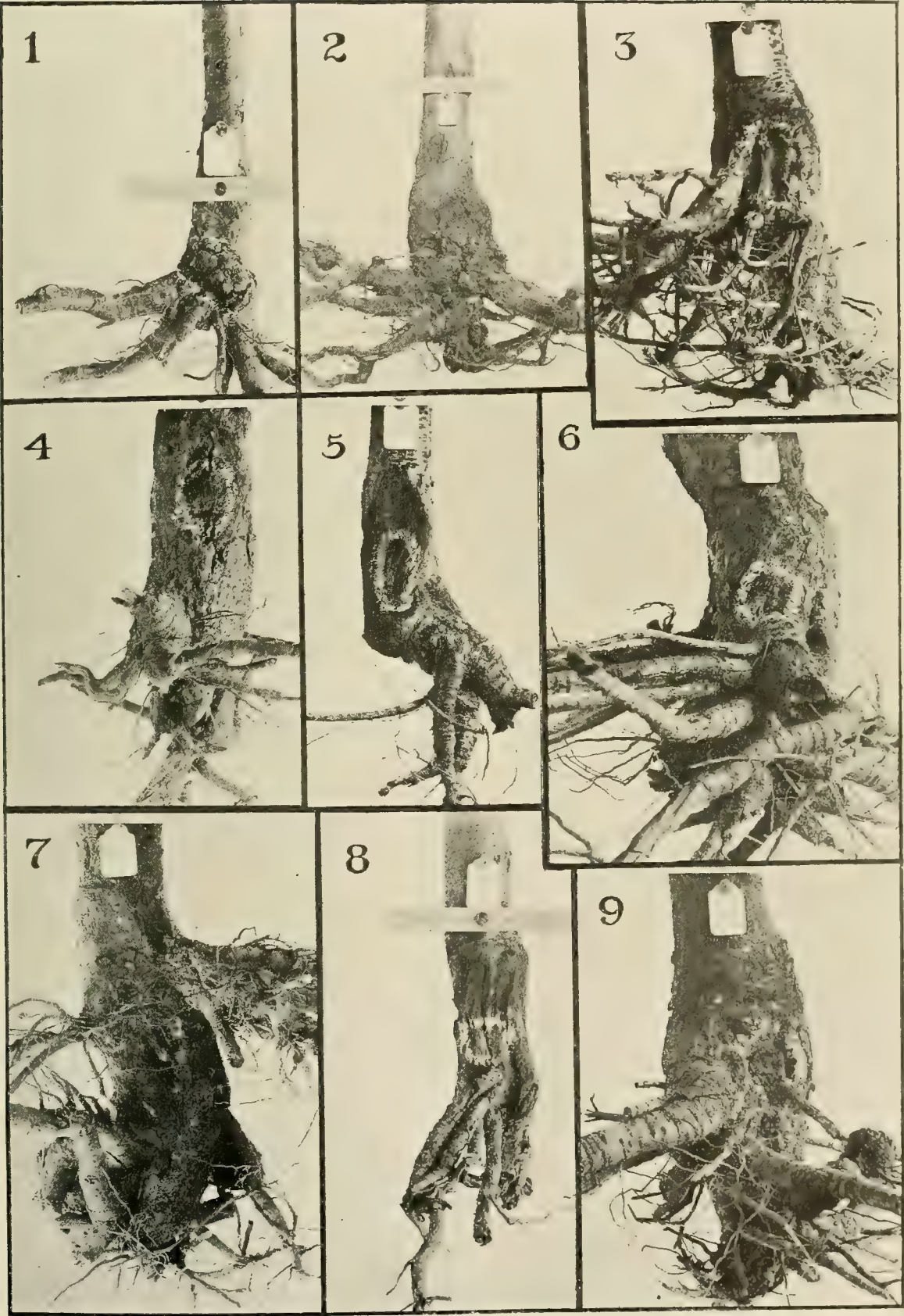
ROOTS OF THE PEACH TREES AFFECTED WITH CROWN-GALL WHICH WERE USED IN THE EXPERIMENT

The behavior of these trees in the field is shown in table 2. In each case read from left to right except in the row at the top, where tree 7 is tree 10 of the records and trees 8, 9, and 10 are 7, 8, and 9 of the records; and in the row at the bottom, where it is necessary to read from right to left. (Special acknowledgment is made to Mr. W. R. Fisher for his technical skill in obtaining suitable prints from most unsatisfactory negatives)

PLATE II. ROOTS OF PEACH TREES FROM THE CROWN-GALL EXPERIMENT

The condition of most of the roots at the time of setting is shown in Plate I, and a record of behavior previous to digging is given in table 2. In cases in which the original gall has disappeared, its location is outlined with chalk

- 1, Tree A-4. Removed September 1, 1915, because of winter injury. Gall apparently inactive
- 2, Tree A-11. Removed October 11, 1916, because of crowding. Crown considerably enlarged and several small galls, but tree apparently in good condition
- 3, Tree E-16. Removed September 1, 1915. A small gall at base of root issuing from near bottom of original gall
- 4, Tree A-18. Removed September 1, 1915, because of winter injury
- 5, Tree F-5. Removed September 1, 1915, because of frost injury. Gall disappeared, and no indication that it could have been a factor in decline of tree
- 6, Tree F-8. Removed September 1, 1915, because of injury by frost and borers
- 7, Tree G-11. Removed September 1, 1915, because of severe injury by frost and borers
- 8, Tree C-18. Removed September 1, 1915. Original gall disappeared
- 9, Tree C-16. Removed September 1, 1915. Original gall disappeared. Three new galls have appeared, two of which show clearly in the photograph



ROOTS OF PEACH TREES FROM THE CROWN-GALL EXPERIMENT
(See legend opposite)

GENERAL CONSIDERATIONS

Field experimentation is very unsatisfactory at best, because so many uncontrollable factors are involved which interfere with a correct interpretation of results. This condition has come to be rather generally understood, the recent analyses by Harris¹⁰ of results from field plot tests, and by Anthony and Waring¹¹ for orchard tests, only serving to indicate how generally unreliable such data are. In addition to the usual vicissitudes encountered in plot testing, an additional set of variables is added when one attempts to compare plants in health and in disease. Means have been devised for overcoming heterogeneity in field plots, but not enough is known about plant responses under conditions of parasitism to make suitable corrections. This is particularly true in the case of the disease under consideration, because Smith has shown that the response to the stimulus of *Bacterium tumefaciens* depends a great deal on the particular tissue affected. This individual variation can be eliminated by increasing the number of plants under test. The number of plants involved in a wholly satisfactory experiment obviously should be considerably greater than was included in this experiment, and the arrangement should be different.

The general indication, however, is that under the conditions of this experiment, crown-gall is not a factor in the growth and development of either apple or peach trees.

The agitation among fruit growers in regard to crown-gall has practically disappeared, doubtless due to the inspection service which causes rejection of trees bearing galls. The writers, however, in 1914 received a consignment of 400 apple trees, of which 28 (7 per cent) bore definite lesions of crown-gall. All of these were planted on private land and their exact location was recorded. While it is likely that many growers treat galled trees just as the writers did, it is to be recalled that the amount of crown-gall on nursery stock has not been large, and the rejection of trees on account of crown-gall has not been a serious loss to nurserymen.

The rôle of crop rotation in reducing losses from crown-gall in the nursery is an interesting phase of the problem, on which, unfortunately, experimental data are too meager to warrant any conclusions.

¹⁰ Harris, J. Arthur. Practical universality of field heterogeneity as a factor influencing plot yields. Journ. agr. res. 19:279-314. 1920.

¹¹ Anthony, R. D., and Waring, J. H. Methods of interpreting yield records in apple fertilization experiments. Pennsylvania Agr. Exp. Sta. Bul. 173:1-42. 1922.

BIOLOGICAL STUDIES OF BACTERIUM TUMEFACIENS

There are a number of biological problems connected with an investigation of crown-gall which are of considerable practical importance. One of the writers (S) was engaged in such work. He had undertaken an extensive series of tests designed to determine the longevity of the crown-gall organism in pure and in mixed culture, and under a variety of conditions.



FIGURE 4. CROWN-GALL ON TOMATO PLANT

The cultures of *Bacterium tumefaciens* recovered in the studies on vitality were tested in this way in order to confirm identification

These were not completed when his connection with the institution was severed, and there was no opportunity to finish them before his untimely death intervened. The data accumulated are fragmentary, but their significance warrants publication at this time. They are given in the following paragraphs.

Persistence of B. tumefaciens in sterilized soil.—In order to determine the persistence of the crown-gall organism in sterilized soil, the following experiment was begun on November 10, 1914. Fifteen small pots were filled with loamy soil and sterilized. Five cubic centimeters of a bouillon culture of *B. tumefaciens*, four days old, was added to each pot. Twelve test tubes were partially filled, some with loam, others with quartz or clay, and to these one cubic centimeter of the culture was added. After four days all pots and tubes were tested to determine the presence in living condition of the organism (figure 4). All were then placed in a box out of doors. On January 2, 1915, the organism was re-

covered from clay, loam, and quartz. On April 14, 1915, a test of the loam soil in the test tubes showed the organism to be present in a living condition. Again on May 24, 1915, the organism was found to be alive in a pot of loam and in a tube of quartz. The next test was made on September 14, 1915. The organism was not recovered from either pots or tubes.

Persistence in unsterilized soil.—Experiments similar to the preceding were instituted with clay, loam, and quartz which had not been sterilized. As this was the most important series from the practical standpoint, it is unfortunate that data on the outcome cannot be found among Dr. Stewart's notes.

Moisture relation.—On February 24, 1914, tests were instituted to determine the vitality of *B. tumefaciens* in dry, moist, and saturated clay, loam, and quartz. Sterilized material in test tubes was used, and the tubes were constantly covered with a bell glass to prevent evaporation. On March 11, 1914, the organism was alive in all nine tubes. On April 10, 1914, the three tubes of dry material were tested and the organism was recovered. In a duplicate set of tubes which were not covered, the organism was dead on the latter date in the dry clay and the dry quartz. All the protected tubes were tested on November 18, 1914, and *B. tumefaciens* was found to be alive except in the tubes of dry clay and dry quartz. Sterilized wheat seeds were planted in some of the tubes of moist loam on April 17. The seeds grew and developed into plantlets. On May 29 a test was made of these tubes and *B. tumefaciens* was found to be alive.

Penetration of soil.—Tubes were filled with moistened quartz and with moist loam, and were sterilized. Five cubic centimeters of a culture of *B. tumefaciens* was poured into one end of each tube, and enough sterilized water was added so that water would drip from the other end. This was caught under aseptic conditions, and at the end of forty-eight hours was tested by plating. The organism was recovered from tubes 60 centimeters in length. No greater lengths were tested, as 60 centimeters represents the approximate penetration into the soil of roots of young trees. Similar tests with clay gave penetration in some instances and not in others. Apparently, if the clay became "puddled" from adding water too rapidly, the organism was filtered out.

While these tests are not extensive, they certainly indicate that, when free from competition, *B. tumefaciens* can live for several months in moist soil of various types, that it can withstand low temperatures and repeated change in temperature at or near the freezing point, and that it may move considerable distances with currents of soil water.

Memoir 67, *Observations on the Life History of Taphrocerus gracilis* (Say) (Beetle, Family Buprestidae), the sixth preceding number in this series of publications, was mailed on September 14, 1923.

AUGUST, 1924

MEMOIR 77

CORNELL UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

A SYSTEMATIC STUDY OF THE ANTHOMYIINAE
OF NEW YORK, WITH ESPECIAL REFERENCE
TO THE MALE AND FEMALE GENITALIA

H. C. HUCKETT

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A SYSTEMATIC STUDY OF THE ANTHOMYIINAE
OF NEW YORK, WITH ESPECIAL REFERENCE
TO THE MALE AND FEMALE GENITALIA

H. C. HUCKETT

In this paper Girschner's (1893) division of the Muscidae calyptrae into two major groups has been adopted as affording characters of greatest taxonomic significance. These two groups are the Tachinidae, with true hypopleural bristles present; and the Anthomyiidae, with true hypopleural bristles absent but occasionally with hypopleural hairs.¹ Townsend's correction (1914) follows according to all accepted rules on nomenclature; that is, since *Musca* Linn. has priority over *Anthomyia* Meig., Muscidae must replace Anthomyiidae. The synonymy is as follows:

1758 *Musca* Linnaeus *p.p.* Syst. Nat., 10th ed., p. 589-601.

1893 *Anthomyiidae* Girschner *p. p.* Berl. ent. Ztschr., vol. 38, p. 311.

1907 *Anthomyiidae* Bezzi and Stein. Kat. Pal. Dipt., vol. 3, p. 599-747.

1921 *Muscaridae* Malloch. Ann. and Mag. Nat. Hist., vol. 7, p. 161.

The family Muscidae includes the subfamilies Muscinae, Phaoniinae, Fanniinae, Hydrotaeinae, Lispinae, Anthomyiinae, Coenosiinae, and Fucellinae (Malloch, 1917c). The subfamily Anthomyiinae is distinguished from the others by the following combination of characters: the scutellum on the ventral surface has a few fine hairs; the vein Cu_2+2dA is produced to the margin of the wing; the sternopleural bristles are arranged in the order 1:1, 1:2, or 2:2, never in the form of an equilateral triangle.

Of the twenty-one genera of Anthomyiinae that are known to occur in North America, nineteen are represented in New York. The genera *Macrophorbia* Mall. and *Alliopsis* Schnb. and Dzied. are at present unrecorded; the genera *Acroptena* Pokorny, *Chortophila* Macq., *Dolichoglossa* Stein, *Ganperdea* Aldr., *Hylephila* Rond., *Phorbia* Rob.-Desv., *Xenophorbia* Mall., and others, are listed in this paper under their respective synonymies. The classification of the genera *Hylemyia* Rob.-Desv. and *Pegomyia* Rob.-Desv. is at present in an unsatisfactory state. The writer feels that, out of the great crowd of species gathered here, lesser units may yet gain recognition, but a full appreciation of their extent and limitations has not yet been definitely perceived.

¹The character of the vein M_{1+2} , which has separated the Anthomyiidae from the Muscidae, is no longer dependable owing to the deflection of the distal part of the vein from a very slight angle to one indistinguishable from that as found in Muscina. A completed series of such a variation includes a large number of typical Anthomyiidae, for example, *Phaonia*, *Limnophora*, *Eulimnophora*, and *Bucephalomysia*.

The following list includes the genera known to be represented in New York in 1924, with the corresponding genotypes:

Genera	Genotypes
<i>Anthomyia</i> Meig.	<i>Musca pluvialis</i> Linn.
<i>Anthomyiella</i> Mall.	<i>Musca pratincola</i> Panz.
<i>Calythea</i> Schnb. & Dzied.	<i>Musca albicincta</i> Fall.
<i>Egle</i> Rob.-Desv.	<i>Egle parva</i> Rob.-Desv.
<i>Emmesomyia</i> Mall.	<i>Emmesomyia unica</i> Mall.
<i>Eremomyia</i> Stein	<i>Eremomyia humeralis</i> Stein
<i>Eremomyoides</i> Mall.	<i>Eremomyia cylindrica</i> Stein
<i>Eustalomyia</i> Kowarz	<i>Musca hilaris</i> Fall.
<i>Hammomyia</i> Rond.	<i>Leucophora cinerea</i> Rob.-Desv. (<i>Anthomyia</i> <i>albiseta</i> v. Ros.)
<i>Hydrophoria</i> Rob.-Desv.	<i>Anthomyia divisa</i> Meig.
<i>Hylemyia</i> Rob.-Desv.	<i>Musca strigosa</i> Fabr.
<i>Kingia</i> Mall.	<i>Kingia quintilis</i> Mall.
<i>Macateeia</i> Mall.	<i>Macateeia protuberans</i> Mall.
<i>Neohylemyia</i> Mall.	<i>Neohylemyia proboscidalis</i> Mall.
<i>Paregle</i> Schnb. & Dzied.	<i>Musca radicum</i> Linn.
<i>Pegomyia</i> Rob.-Desv.	<i>Musca hyoscyami</i> Panz.
<i>Pogonomyza</i> Schnb. & Dzied.	<i>Anthomyza cinerosa</i> Zett.
<i>Proboscimyia</i> Bigot	<i>Proboscimyia siphonina</i> Bigot
<i>Prosalpia</i> Pokorný	<i>Anthomyza billbergi</i> Zett.

About five hundred species of Anthomyiinae have been recorded from North America, and, of these, ninety-two species have thus far been collected and identified from New York. A list of these species follows:

<i>Anthomyia pluvialis</i> Linn.	<i>Hylemyia albula</i> Fall.
<i>Anthomyiella pratincola</i> Panz.	<i>alcatheae</i> Walk.
<i>Calythea albicincta</i> Fall.	<i>antiqua</i> Meig.
<i>Egle muscaria</i> Fabr.	<i>arnolitra</i> sp. nov.
<i>parva</i> Rob.-Desv.	<i>betarum</i> Lint.
<i>Emmesomyia apicalis</i> Mall.	<i>brassicae</i> Bouché
<i>Eremomyia humeralis</i> Stein	<i>cilicrura</i> Rond.
<i>vernalis</i> sp. nov.	<i>coenosiaeformis</i> Stein
<i>Eremomyoides cylindrica</i> Stein	<i>curripes</i> Mall.
<i>fuscipes</i> Mall.	<i>depressa</i> Stein
<i>similis</i> Mall.	<i>florilega</i> Zett.
<i>Eustalomyia festiva</i> Zett.	<i>fugax</i> Meig.
<i>vittipes</i> Zett.	<i>grandivillosus</i> sp. nov.
<i>Hammomyia johnsoni</i> Stein	<i>inconspicuus</i> sp. nov.
<i>maculata</i> Stein	<i>innocua</i> Mall.
<i>marylandica</i> Mall.	<i>inornata</i> Stein
<i>paludis</i> Joh.	<i>ithacensis</i> sp. nov.
<i>unilineata</i> Zett.	<i>laevis</i> Stein
<i>Hydrophoria ambigua</i> Fall.	<i>lasciva</i> Zett.
<i>divisa</i> Meig.	<i>latifrontalis</i> sp. nov.
<i>flavohalterata</i> Mall.	<i>latipennis</i> Zett.
<i>orientalis</i> sp. nov.	<i>megacephala</i> Mall.
<i>ruralis</i> Meig.	<i>piloseta</i> Mall.
<i>uniformis</i> Mall.	<i>pluvialis</i> Mall.

Hylemyia pullula Zett.
sepia Meig.
setigera Joh.
setitarsata sp. nov.
spizellae sp. nov.
testacea Stein
trichodactyla Rond.
trivittata Stein
unidorsalis sp. nov.
variata Fall.
Kingia quintilis Mall.
Macateeia protuberans Mall.
Neohylemyia mallochii sp. nov.
Paregle cinerella Fall.
radicum Linn.
Pegomyia acutipennis Mall.
affinis Stein
bicolor Wied.
calyptata Zett.
connexa Stein
dissecta Meig.
fringilla Mall.

Pegomyia fuscofasciata Mall.
geniculata Bouché
hyoscyami Panz.
juvenilis Stein
lipsia Walk.
littoralis Mall.
luteola Mall.
nigritarsis Zett.
rubivora Coq.
ruficeps Stein
unicolor Stein
vanduzeei Mall.
winthemi Meig.
Pogonomyza campestris sp. nov.
cinerosa Zett.
flavipennis Fall.
gleniensis sp. nov.
proboscidalis Mall.
spinosissima Mall.
Proboscimyia siphonina Bigot
Prosalpia angustitarsis Mall.
silvestris Fall.

The terminology used by Malloch and other writers in speaking of the setae of the legs is used in this study, as it is less confusing than some others. According to this system, as shown in the accompanying table, it is assumed that the fore, mid, and hind legs lie in one plane, at right angles to the body of the insect. This would bring all parts of the legs in a uniform position in relation to the substrata. By taking a cross section of any part of the leg in this position (figure 1), the surfaces of such a section in their relation to the position of the insect's body would be described as follows: anterior (Ant.), posterior (Post.), dorsal (D.), ventral (V.). Intermediate surfaces would be described as anterodorsal (Ant. D.), posterodorsal (Post. D.), anteroventral (Ant. V.), posteroventral (Post. V.).

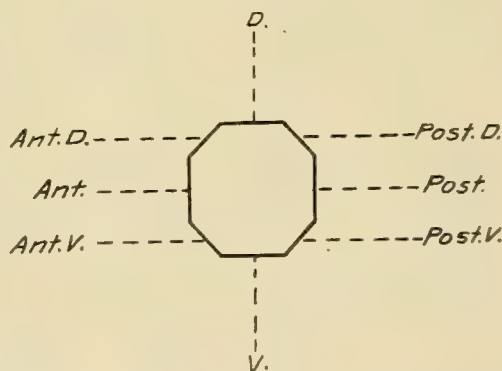


FIGURE 1. DIAGRAM OF CROSS SECTION THROUGH THE LEG OF AN INSECT, TO SHOW APPLICATION OF DESCRIPTIVE TERMINOLOGY

(Abbreviations explained in text)

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COMPARATIVE TABLE OF TERMINOLOGIES

Malloch and others	Stein and others					
Fore, mid, hind legs, femora and tibiae	Fore legs		Middle legs		Hind legs	
	Femora	Tibiae	Femora	Tibiae	Femora	Tibiae
Anterior surface	Innen	Zugekehrt	Vorn (front)	Vorn (anterior)	Aussen (lateral)	Abgewandt
Posterior surface	Aussen (lateral)	Abgewandt	Hinten (hind)	Hinten (posterior)	Innen	Zugekehrt
Dorsal surface	Oberseits (upper side)	Aussen (anterior extensor)	Oberseits (upper side)	Aussen (extensor)	Oberseits (extensor)	Aussen (extensor)
Ventral surface	Unterseits (under side)	Innen (flexor)	Unterseits (under side)	Innen (flexor)	Unterseits (flexor)	Innen (flexor)
Anterodorsal surface	Oberseits zugekehrt	Aussen zugekehrt	Oberseits vorn	Aussen vorn (anterior extensor)	Oberseits abgewandt	Aussen abgewandt (outer extensor)
Anteroven-tral surface	Unterseits zugekehrt	Innen zugekehrt	Unterseits vorn	Innen vorn (anterior flexor)	Unterseits abgewandt	Innen abegwandt (outer flexor)
Posterodorsal surface	Oberseits abgewandt	Aussen abgewandt (outer extensor)	Oberseits hinten	Aussen hinten (posterior extensor)	Oberseits zugekehrt	Aussen zugekehrt (posterior extensor)
Posteroventral surface	Unterseits abgewandt	Innen abgewandt	Unterseits hinten	Innen hinten (posterior flexor)	Unterseits zugekehrt	Innen zugekehrt (inner flexor)

KEY TO THE GENERA OF ANTHOMYIINAE

The following key separates the genera of Anthomyiinae:

1. Eyes hairy2
 Eyes bare3
2. Abdomen narrow, almost parallel-sided; eyes, in male contiguous, in female separated
 by at least one-third width of head..... *Lasiops* Meig.
 Abdomen broadly oval; eyes of male and female distinctly but not widely separated.
 *Alliopsis* Schnb. & Dzied.
3. Propleura hairy4
 Propleura bare.....6
4. Prosternum, pteropleura, and hypopleura hairy..... *Eremomyoides* Mall.
 Prosternum, pteropleura, and hypopleura bare.....5
5. Arista bare; proboscis slender, elongated..... *Kingia* Mall.
 Arista plumose; proboscis robust, normal in length..... *Anthomyia* Meig.
6. Hypopleura hairy in front of and behind spiracle.....7
 Hypopleura bare.....8
7. Arista bare; oral margin, in profile, distinctly protruded beyond vibrissal angle.
 *Calythea* Schnb. & Dzied.
 Arista plumose; oral margin, in profile, not noticeably protruded beyond vibrissal angle.
 *Hydrophoria* Rob.-Desv.
8. Lower calyptra distinctly protruding far beyond upper.....9
 Lower calyptra not conspicuously protruding beyond upper, subequal.....13
9. Pteropleura with a noticeable bristle on dorsal margin, below base of wing.
 *Emmesomyia* Mall.
 Pteropleura bare.....10
10. Arista plumose..... *Hydrophoria* Rob.-Desv.
 Arista pubescent or bare.....11
11. Fore tibia with a long dorsal preapical bristle, equal in length to tarsal segments 1 and
 2; hind tibia with one, conspicuous dorsal bristle..... *Anthomyiella* Mall.
 Fore tibia with the dorsal preapical bristle not longer than tarsal segment 1; hind tibia
 with more than one conspicuous dorsal bristle.....12
12. Mid tibia with a median anteroventral bristle..... *Paregle* Schnb. & Dzied.
 Mid tibia with no median anteroventral bristle..... *Pegomyia* Rob.-Desv.
13. Head, thorax, and abdomen whitish gray; thorax with three black, well-marked vittae;
 abdomen with black dorsocentral vitta and incisures..... *Eustalomyia* Kowarz
 Head, thorax, and abdomen not so marked.....14
14. Hind tibia with a very long, strong, mid anterodorsal and posterodorsal bristle, each about
 half as long as the tibia itself..... *Prosalpia* Pokorný
 Hind tibia with no such bristles on antero- and posterodorsal surfaces, the longest bristle
 being less than half the length of the tibia itself.....15
15. Cheeks broad; oral margin narrowly constricted anteriorly by the approximation of
 the vibrissae, in extent reduced to a distance less than breadth of cheek directly ventrad
 of eye.....16
 Cheeks narrow; oral margin not constricted anteriorly by the approximation of the
 vibrissae, in extent equal to, or greater than, breadth of cheek directly ventrad of eye. 19
16. Arista with sparse plumose hairs; conspicuously swollen at base..... *Neohylemyia* Mall.
 Arista pubescent or bare.....17
17. Proboscis very slender, elongate, as long as, or longer than, length of thorax.
 *Proboscimyia* Bigot
 Proboscis normal, not so long as thorax.....18
18. Males with abdomen cylindrical; hind tibia with a series of setulae or hairs on postero-
 ventral surface; females with two or more strong, curved, apical spines protruding
 from ovipositor; frons of females less than one-third width of head.
 *Hammomyia* Rond.

- Males with abdomen depressed, truncate; hind tibia with posteroventral surface bare in both sexes; females with no apical spines protruding from ovipositor; frons of females more than one-third width of head. *Pegomyia* Rob.-Desv.
19. Hind tibia with two posterodorsal bristles. *Pegomyia* Rob.-Desv.
Hind tibia with less or more than two posterodorsal bristles. 20
20. Vibrissal angle and oral margin noticeably protruded anteriorly when viewed in profile. 21
Vibrissal angle and oral margin but moderately protruded anteriorly at most, when viewed in profile. 22
21. Vibrissal area clothed with numerous longish accessory setulae which invade ventral half of facial margin; third antennal segment one and a half times as long as broad; antennae separated at base by only a slight facial elevation. *Macateeia* Mall.
Vibrissal area with only a few setulae; facial margin not possessed with setulae; third antennal segment nearly as broad at its apex as its entire length; antennae separated at base by a broad, flattened, facial prominence. *Egle* Rob.-Desv.
22. Thorax with four postsutural dorsocentral bristles. *Macrophorbia* Mall.
Thorax with three postsutural dorsocentral bristles. 23
23. Tibiae blackish; femora black. 24
Tibiae yellow; femora yellow or infuscated, or both. 26
24. Proboscis stout, fleshy, thicker than fore femur. *Pogonomyza* Schnb. & Dzied.
Proboscis not noticeably stout or thickened. 25
25. Hind tibia with two or three anterodorsal bristles; posthumeral bristles duplicated, the second, or lower, equal in size and length to the first, or upper, in males; females without cruciate bristles. *Eremomyia* Stein
Hind tibia with four or more anterodorsal bristles; posthumeral bristles, when duplicated, of unequal size and length, the second, or lower, shorter and weaker than the first, or upper. *Hylemyia* Rob.-Desv.
26. Hind tibia with a series of hairs or setulae on posteroventral surface in males; females with well-developed cruciate bristles. *Hylemyia* Rob.-Desv.
Hind tibia bare on posteroventral surface in males; females without cruciate bristles, or having them only minutely developed. *Pegomyia* Rob.-Desv.

SYNONYMIES, RECORDS, DESCRIPTIONS, AND KEYS TO SPECIES

Genus *Anthomyia* Meigen

- 1803 Meig. Illiger's Mag., vol. 2, p. 281, no. 111.
1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 298.

Anthomyia pluvialis Linnaeus

- 1761 *Musca pluvialis* Linn. Fauna Suec., vol. 2, p. 455, no. 1844.
1830 *Anthomyia chorea* Rob.-Desv. Essai Myod., p. 582, no. 2.
1830 *Anthomyia flavescens* Rob.-Desv. Essai Myod., p. 582, no. 3.
1830 *Anthomyia soror* Rob.-Desv. Essai Myod., p. 583, no. 4.
1838 *Anthomyia quinquemaculata* Macq. and others. Hist. Nat. Iles Canaries, vol. 2, part 13, p. 116, no. 92.
1866 *Anthomyia pluvialis* var. *orocellaris* Rond. Atti Soc. Milano, vol. 9, p. 147, no. 1.
1866 *Anthomyia pluvialis* var. *imbrida* Rond. Atti Soc. Milano, vol. 9, p. 148, no. 3.
1868 *Anthomyia tempestatum* Thoms. Dipt. Eug. Res., p. 556, no. 196.
1884 *Anthomyia oculifera* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 299, no. 8.

Records.—Earliest: Hempstead, Long Island, April 10, 1921. Latest: Black Mountain, Lake George, September 4, 1920 (collected by M. D. Leonard). 43 specimens: 18 males, 25 females. Figures 43, 97, 142, 179, on plates in this memoir.

Genus *Anthomyiella* Malloch

- 1920 Stein. Arch. Naturgesch., (1918) vol. 84, part 9, p. 63. *Calythea* p.p.
1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 174.

Anthomyiella pratincola Panzer1809 *Musca pratincola* Panz. Fauna Germ., p. 108, no. 12.1826 *Anthomyia pratinicola* Meig. Syst. Besch., vol. 5, p. 162, no. 140.1845 *Aricia praticola* Zett. Dipt. Scand., vol. 4, p. 1559, no. 174.

Localities.—1 ♀, Rochester Junction, June 16, 1914; 1 ♀, Little Neck, Long Island, June 25, 1921; 2 ♂, 1 ♀, Atwaters (near Ithaca), July 16, 1921; 3 ♂, 1 ♀, Syosset, Long Island, July 7, 1921; 11 ♂, 5 ♀, July 27, 1921; 1 ♂, Riverhead, Long Island, September 18, 1922. 26 specimens: 17 males, 9 females. Figures 35, 144, 156, 181, on plates in this memoir.

Genus *Calythea* Schnabl and Dziedzicki

1911 Schnb. and Dzied. Die Anthomyiden, p. 111.

1915 Stein. Suppl. Ent., vol. 4, p. 28. Fallacia.

1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 299.

Calythea albicincta Fallén1820 *Musca albicincta* Fall. Fauna Suec. Musc., p. 73.1868 *Anthomyia micropteryx* Thoms. Dipt. Eug. Res., p. 555, no. 194.1884 *Anthomyia monticola* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 297, no. 4.1884 *Anthomyia anthracina* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 298, no. 7.1913 *Anthomyia bidentata* Mall. Proc. U. S. Nat. Mus., vol. 45, p. 606.

Localities.—1 ♂, 1 ♀, Hempstead, Long Island, April 10, 1921; 1 ♀, Ithaca, May 8, 1915; 1 ♀, Buttermilk, Ithaca, July 18, 1920; 1 ♂, 1 ♀, September 25, 1920; 1 ♂, 1 ♀, McLean Bogs (near Ithaca), September 11, 1920. 8 specimens: 3 males, 5 females. Figures 42, 86, 143, 182, on plates in this memoir.

Genus *Egle* Robineau-Desvoidy

1830 Rob.-Desv. Essai Myod., p. 584.

1911 Schnb. and Dzied. Die Anthomyiden, p. 104.

1920 Stein. Arch. Naturgesch., (1918) vol. 84, part 9, p. 85. Chortophila *p.p.*

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 175. Xenophorbia.

Generic characters.—Third antennal segment barely longer than second, and much broader at apex than at base. Antennae separated at base by a broad, flattened, facial prominence. Vibrissal angle (buccae), in profile, produced; distance between vibrissae and lower margin of eye equal to length of antennae. Oral margin, in profile, produced anteriorly. Post-humeral bristles duplicated.

The species of *Egle* are separated by the following key:

Males and females

1. Four postsutural dorsocentral bristles; scutellum with accessory setulae on discal area. *muscaria* Fabr.
Three postsutural dorsocentral bristles; scutellum bare on discal area. . . *parva* Rob.-Desv.

Egle muscaria Fabricius1775 ?*Stomoxys muscaria* Fabr. Ent. Syst., vol. 4, p. 395.1830 ?*Egle labiata* Rob.-Desv. nec Fabr. Essai Myod., p. 586, no. 7.1834 ?*Anthomyia frieseana* Bouché. Naturg. Ins., vol. 1, p. 87, no. 76.1838 *Anthomyza brevicornis* Zett. Ins. Lapp., p. 683, no. 99.1849 *Anthomyia determinata* Walk. List Dipt. Brit. Mus., part 4, p. 955, ♀.1849 *Eriphia ciliata* Walk. List Dipt. Brit. Mus., part 4, p. 961.1870 *Chortophila palpella* Rond. Bull. Soc. Ent. Ital., vol. 2, p. 328, no. 36.

Localities.—3 ♂, Oakwood, Staten Island, April 22, 1920 (collected by J. Bequaert and E. Burns); 1 ♂, Ithaca, April 20, 1895; 1 ♂, April 23, 1915; 1 ♂, Nyack, July 12, 1884; 2 ♂,

1 ♀, Baiting Hollow, near Riverhead, Long Island, April 22, 1923; 1 ♀, April 29, 1923; 3 ♀, April 13, 1924. 13 specimens: 8 males, 5 females. Figures 149, 151, 154, on plates in this memoir.

Egle parva Robineau-Desvoidy

1826 ?*Anthomyia minuta* Meig. Syst. Besch., vol. 5, p. 177, no. 163.

1830 *Egle parva* Rob.-Desv. Essai Myod., p. 590, no. 20.

1838 *Anthomyia lepida* var. *b* Zett. Ins. Lapp., p. 686, no. 110.

Localities.—1 ♂, Oakwood, Staten Island (collected by E. J. Burns); 1 ♂, Ithaca, April 26, 1914; 1 ♂, May; 1 ♀, Ithaca, April 20, 1920 (collected by R. C. Shannon); 1 ♀, no locality nor date given; 3 ♂, 18 ♀, Baiting Hollow, near Riverhead, Long Island, April 22, 1923; 1 ♀, April 27, 1923; 5 ♂, 3 ♀, April 29, 1923; 1 ♂, April 13, 1924. 36 specimens: 12 males, 24 females. Figures 146, 150, 153, on plates in this memoir.

Egle parva and *E. muscaria* are to be found together in the spring frequenting the catkins of the pussy willow, *Salix discolor*.

Genus *Emmesomyia* Malloch

1917 Mall. Bul. Brooklyn Ent. Soc., vol. 12, p. 113.

Emmesomyia apicalis Malloch

1917 Mall. Bul. Brooklyn Ent. Soc., vol. 12, p. 115.

Localities.—1 ♀, Lakeville, Long Island, August 18, 1921; 1 ♀, Cold Spring Harbor, Long Island, September 2, 1921; 1 ♀, September 3, 1921; 1 ♀, September 4, 1922. 4 specimens, all females. Figure 157 on Plate XIII.

Genus *Eremomyia* Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 223.

Generic characters.—Propleura, mesopleura, hypopleura, and prosternum bare. Legs black; hind tibiae with two or three anterodorsal bristles, and three or more posterodorsal bristles; posthumeral bristles duplicated, the second or lower bristle equal in size and length to the first or upper in the male; female without cruciate bristles.

The following key separates the species of *Eremomyia*:

Males and females

1. Vibrissal areas with several short, robust setulae; *r-m* and *m-cu* cross-veins at least faintly clouded; proboscis moderately stout; wings grayish.....*humeralis* Stein
Vibrissal areas without any noticeable collection of short setulae; cross-veins clear; wings yellowish.....*vernalis* sp. nov.

Eremomyia humeralis Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 224.

Records.—Earliest: Ithaca, March 18, 1920 (collected by R. C. Shannon). Latest: Ithaca, May 5, 1922. 157 specimens: 87 males, 70 females. Figures 38, 94, 145, 166, on plates in this memoir.

There are differences between the males of the above series and a male specimen of *humeralis* from Idaho. These differences are not thought of sufficient value to be specific. The specimens from Ithaca are slightly smaller and not so strongly bristled. The vibrissal angle possesses a more noticeable collection of robust setulae; the thorax has, in addition, a weak,

uniform pair of presutural acrostical bristles caudad of the strong median pair; the fore tibia possesses one longish posterior bristle and one weak dorsal bristle; the mid femur has the anteroventral surface bare; the mid tibia has one anterior, one anterodorsal, one posterodorsal, and two weaker posterior bristles; whereas, in *humeralis*, the fore tibia possesses two strong dorsal and two strong posteroventral bristles, and the mid tibia has two anteroventral and one anterior setae, one noticeably stout and long anterodorsal and posterodorsal bristle, and two weak posterior bristles. The processes of the fifth sternum in the specimens from Ithaca and Idaho are alike, so far as can be seen.

Eremomyia vernalis sp. nov.

Male.—Blackish species, with dense, light grayish pollen, subshining. Head blackish; parafrontals, parafacials, and cheeks with dense, silvery gray pruinescence. Antennae, palpi, and proboscis, blackish. Thorax, viewed from above and in front, with a broad, brownish gray, median vitta, and faint indications of two narrow sublaterals; lateral margins of notal disk with dark fascia; humeral and notopleural callosities with light grayish pollen. Abdomen, viewed from above and behind, with dense light grayish pollen; a broad, uniform, dorsocentral vitta; hypopygium shining. Legs blackish. Pulvilli fuscous. Wings tinged with yellow; veins yellowish brown; cross-veins clear. Calyptrae whitish. Halteres yellowish.

Eyes separated, at narrowest part, by a distance equal to diameter of anterior ocellus. Parafrontals and parafacials, in profile, not prominent, the latter receding to narrow proportions ventrad; cheeks smooth, tapering caudad, bristles confined to ventral margin; vibrissae longish, with few accessory setulae. Second antennal segment rugose, shining, with four or more punctures toward distal margin on inner side; third antennal segment villous, about twice as long as second; arista bare, with minute hairs at base. Thorax with numerous accessory setulae; one moderately stout pair and one weaker longish pair of presutural acrosticals, the remainder setulose; postsutural acrosticals hairlike; pra longer than posterior notopleural bristle. Sternopleurals, 1:3, the ventral bristle of the posterior group weaker than the upper two. Abdominal terga with dense, strong, semi-erect bristles and setulae; first and second abdominal sterna with a dense growth of fine, weaker bristles; third and fourth sterna with fewer and more scattered setulae; hypopygium clothed with fine, curling hairs and bristles; processes of fifth sternum with fine hairs along inner margin. Fore tibia with one anterodorsal and two longish posteroventral bristles. Mid femur with a small tuft of fine, longish setae at base of posterior surface; basal bristle on ventral surface fine, and curving apicad; posteroventral surface with two or three bristles along proximal half; mid tibia with one anterodorsal, one posterodorsal, and three posteroventral bristles. Hind femur with a series of strong anteroventral bristles, one or more posteroventral bristles, and an apical series of fine posteroventral setae; hind tibia with two anteroventral, two or three anterodorsal, and three or four posterodorsal bristles; posterior surface apparently without a series of setulae, the presence or absence of these being difficult to discern because of the hairy character and semi-erect position of the hairs of the hind tibiae. Pulvilli and claws large. Costal thorn small. Upper calyptra covering the lower. Length, 5–6 mm.

Female.—Similar to male except for the following characters: Color cinereous, a lighter shade than in male, with ashy gray pollen. Parafrontals, parafacials, and cheeks grayish pruinose, with dark reflections. Frontal vitta reddish anteriorly. Abdomen non-vittate. Eyes separated by a broad frontal vitta; cruciates absent or weakly developed. Proboscis stout. Abdomen sparsely covered with weaker, more appressed bristles and setulae. Fore tibia with one dorsal and one posteroventral bristle. Mid femur with one proximal anteroventral bristle, and two or three proximal posteroventral bristles; mid tibia with one or two anterodorsal, one posterodorsal, and two posteroventral bristles. Hind tibia without a series of setulae on posterior surface. Tarsal claws and pulvilli short. Length, 6–7 mm.

Records.—Earliest: Ithaca, March 25, 1917 (collected by R. C. Shannon). Latest: Ithaca, July 1, 1915. 200 specimens. Figures 37, 93, 138, 165, on plates in this memoir.

Type and allotype.—In the Cornell University collection, Ithaca, New York.

Paratypes.—In the United States National Museum collection, Washington, D. C., and the Cornell University collection, Ithaca, New York.

Eremomyia vernalis can be readily distinguished from *E. humeralis* by the yellowish tinge to the wings, the unclouded appearance of the cross-veins, and the lack of robust setulae on the vibrissal angle.

Genus *Eremomyoides* Malloch

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 223. *Eremomyia p.p.*

1918 Mall. Proc. Biol. Soc. Wash., vol. 31, p. 67.

1921 Mall. Canad. Ent., vol. 53, p. 76.

The species of *Eremomyoides* may be separated according to the following key:

Males and females

1. Hind tibia reddish. *cylindrica* Stein
Hind tibia blackish. 2
2. Second antennal segment angulated at apex on inner side; costal setulae weak, not longer than diameter of costal vein. *fuscipes* Mall.
Second antennal segment transverse at apex on inner side, not angulated; costal setulae strong, longer than diameter of costal vein. *similis* Mall.

Eremomyoides cylindrica Stein

1898 *Eremomyia cylindrica* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 226.

1898 *Pegomyia setosa* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 245, ♀.

Records.—Earliest: Ithaca, March 25, 1917. Latest: Ithaca, June 5, 1915. 200 specimens. Figures 31, 96, 137, 170, on plates in this memoir.

Eremomyoides fuscipes Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 182.

Localities.—1 ♂, Cooper Cemetery, Staten Island, March 17, 1918 (collected by E. Burns); 1 ♂, Ithaca, April 7, 1900. 2 specimens, both males. Figures 39, 95, 139, on plates in this memoir.

Eremomyoides similis Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 183.

Localities.—1 ♂, Ithaca, March 25, 1917 (collected by R. C. Shannon); 1 ♂, April 18, 1920; 1 ♂, Fall Creek, Ithaca, April 24, 1922 (collected by L. S. West). 3 specimens, all males. Figures 39, 95, 139, on plates in this memoir.

Genus *Eustalomyia* Kowarz

1864 Liroy. Atti Ist. Veneto, ser. 3, vol. 9, p. 909. *Dendrophila*.

1873 Kowarz. Verh. Zool.-Bot. Ges. Wien, vol. 23, p. 461.

1891 Kowarz. Wien. Ent. Ztg., vol. 10, p. 101.

The following key separates the species of *Eustalomyia*:

Males and females

1. Legs and palpi blackish, the latter brownish proximad; pra longer than posterior notopleural bristle; arista densely pubescent; scutellum setulose. *festiva* Zett

Legs and palpi yellowish, the latter sometimes infuscated distad; pra shorter than posterior notopleural bristle; arista sparsely plumose.....*vittipes* Zett.

Eustalomyia festiva Zetterstedt

1845 Zett. Dipt. Scand., vol. 4, p. 1424, no. 34.

Localities.—1 ♂, Ithaca, June, 1922 (collected by H. C. Hallock); 1 ♀, Ithaca, June; 1 ♀, Mount Whiteface (alt. 2000–4000 ft.), August 23–24, 1916. 3 specimens: 1 male, 2 females. Figure 167 on Plate XV.

Eustalomyia vittipes Zetterstedt

1845 *Anthomyza vittipes* Zett. Dipt. Scand., vol. 4, p. 1649, no. 16.

1852 *Anthomyza decorata* Zett. Dipt. Scand., vol. 11, p. 4323, nos. 21, 22.

1866 *Anthomyia arrogans* Rond. Atti Soc. Milano, vol 9, p. 185, no. 17.

Localities.—1 ♂, Coy's Glen, Ithaca, May 14, 1922; 1 ♂, June 12, 1920; 1 ♀, August 1, 1920; 1 ♂, Aurora, May 30, 1920; 1 ♀, Lake Ridge (near Ithaca), June 1, 1920; 1 ♀, Ringwood (near Ithaca), June 26, 1920; 1 ♀, Syosset, Long Island, July 19, 1921; 1 ♂, 1 ♀, Old Forge, First Lake, August 23, 1922 (collected by M. D. Leonard). 9 specimens: 4 males, 5 females. Figures 47, 92, 141, 180, on plates in this memoir.

Genus *Hammomyia* Rondani

1830 Rob.-Desv. Essai Myod., p. 562. *Leucophora*.

1877 Rond. Dipt. Ital., Prodr., vol. 6, p. 233, no. 23. *Hylephila*.

1877 Rond. Dipt. Ital., Prodr., vol. 6, p. 236, no. 24.

1919 Stein. Arch. Naturgesch., (1917) vol. 83, part 1, p. 152, no. 71. *Ammomyia*.

1921 Mall. Canad. Ent., vol. 53, p. 78.

The following key separates the species of *Hammomyia*:

Males and females

1. Tibiae entirely black; arista with minute pubescence.....2
The hind tibiae at least reddish and largely infuscated; arista with longish pubescence, the hairs longer than basal diameter of arista; pra absent.....4
2. Mid tibia with one or more ventral bristles; third antennal segment one-half longer than wide; arista shorter than vibrissae.....3
Mid tibia without a ventral bristle; third antennal segment twice as long as wide; arista longer than vibrissae.....*maculata* Stein
3. Pra longer than posterior notopleural bristle; one or more pairs of bristle-like presutural acrosticals; fore femur with a short median series of semi-erect setulae on anterior (inner) surface; cruciate bristles present.....*unilineata* Zett.
Pra shorter than posterior notopleural bristle; presutural acrostical bristles weak and setulose; fore femur without a median series of semi-erect setulae on anterior (inner) surface; cruciate bristles absent.....*paludis* Joh.
4. Abdomen with distinct brown lateral markings on posterior half of each tergum; cross-veins *r-m* and *m-cu* clouded; female with a mid-ventral bristle on mid tibia.
johnsoni Stein
Abdomen with indefinite brownish transverse incisures along anterior and posterior margins of each tergum; cross-veins *r-m* and *m-cu* not infuscated; female with no mid-ventral bristle on mid-tibia.....*marylandica* Mall.

Hammomyia johnsoni Stein

1898 *Hylemyia johnsoni* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 215.

Records.—Earliest: Coy's Glen, Ithaca, May 14, 1921. Latest: Ithaca, July 10, 1920. 76 specimens: 49 males, 27 females. Figures 45, 90, 135, 184, on plates in this memoir.

Hammomyia maculata Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 229, no. 1.

Locality.—1 ♀, Ithaca, 19—.

Hammomyia marylandica Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 185.

Locality.—2 ♂, 3 ♀, Baiting Hollow, near Riverhead, Long Island, May 13, 1923; 12 ♂, May 18, 1923; 3 ♂, 2 ♀, May 20, 1923; 2 ♂, May 27, 1923. 24 specimens: 19 males, 5 females.

Hammomyia paludis Johannsen

1917 Joh. Ent. News, vol. 28, p. 323.

Records.—Earliest: Glen Head, Long Island, April 5, 1921. Latest: Ithaca, July 1, 1917. 30 specimens: 19 males, 11 females. Figures 44, 91, 136, 183, on plates in this memoir.

Hammomyia unilineata Zetterstedt

1830 ?*Leucophora floralis* Rob.-Desv. Essai Myod., p. 563, no. 2.

1838 *Anthomyza unilineata* Zett. Ins. Lapp., p. 675, no. 63.

1901 *Anthomyza buccata* Pand. nec Fall. Rev. Ent. France, vol. 20, p. 301, no. 5.

Localities.—1 ♂, Glen Head, Long Island, April 14, 1921; 1 ♂, Taughannock Falls, near Ithaca, April 21, 1917 (collected by R. C. Shannon); 2 ♀, Valley Stream, Long Island, April 27, 1921; 1 ♀, Ithaca, May 1, 1915; 1 ♂, May 2, 1900; 1 ♂, Moshulu, June 18, — (Amer. Mus. Nat. Hist.). 7 specimens: 4 males, 3 females. Figures 46, 89, 134, 185, on plates in this memoir.

Hammomyia unilineata is larger than *H. paludis*, and possesses stronger and more abundant bristles and hairs.

Genus *Hydrophoria* Robineau-Desvoidy

1830 Rob.-Desv. Essai Myod., p. 503, no. 11.

1830 Rob.-Desv. Essai Myod., p. 527, no. 21. Zaphne.

1893 Pokorny. Wien. Ent. Ztg., vol. 12, p. 60. Acroptena.

1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 296.

1920 Mall. Canad. Ent., vol. 52, p. 253.

The species of *Hydrophoria* may be distinguished according to the following keys:

Males

1. Hypopleura with hairs on upper margin in front of spiracle; mid tibia with no anteroventral bristle.....*divisa* Meig.
Hypopleura without hairs on upper margin in front of spiracle; mid tibia with an anteroventral bristle or setula.....2
2. Abdomen with second and third terga partly yellowish testaceous; legs brownish.
Abdomen with second and third terga blackish; legs blackish.....3
3. Eyes closely approximate, separated at narrowest part by a distance equal to diameter of anterior ocellus; fourth tergum not narrowed obliquely ventrad, of uniform breadth throughout.....4
Eyes separated by a distance at least equal to that between posterior ocelli; fourth tergum narrowed obliquely ventrad, lateral margin much shorter than breadth along dorsum.....5

4. Processes of fifth sternum with long, curling hairs and bristles; third antennal segment twice as long as second; sternopleurals, 2:2.....*uniformis* Mall.
Processes of fifth sternum with short hairs and bristles, the inner border matted with dense, short, black hairs; third antennal segment three times as long as second; sternopleurals, 1:2.....*orientalis* sp. nov.
5. Calyptrae brownish; posteroventral angles of fourth tergum with strong bristles.
flavohalterata Mall.
Calyptrae whitish; posteroventral angles of fourth tergum with a dense tuft of short, fine bristles.....*ambigua* Fall.

Females

1. Hypopleura with hairs on upper margin in front of spiracle; mid tibia with no anteroventral bristle.....*divisa* Meig.
Hypopleura without hairs on upper margin in front of spiracle; mid tibia with an anteroventral bristle.....2
2. Abdomen partly yellowish testaceous at base; legs yellowish brown.....*ruralis* Meig.
Abdomen wholly blackish; legs blackish.....3
3. Hind femur with several long, fine bristles along basal half of posteroventral surface...4
Hind femur bare on posteroventral surface except for the usual apical setae; one basal bristle present.....*ambigua* Fall.
4. Parafacials, in profile, but little narrowed ventrad, at base of antennae equal in breadth to width of third antennal segment; presutural acrosticals represented by four or five series of weak hairs.....*flavohalterata* Mall.
Parafacials in profile narrow, not equal in breadth to width of third antennal segment; presutural acrosticals represented by three or four pairs of setulae with a few scattered hairs between them.....*uniformis* Mall.

Hydrophoria ambigua Fallén

- 1823 *Musca ambigua* Fall. Musc., p. 56, no. 43.
1838 *Anthomyza lineatocollis* Zett. Ins. Lapp., p. 679, no. 78.
1862 *Spilogaster divisa* Schin. nec Meig. Fauna Austr., part 1, p. 609.

Records.— Earliest: Ithaca, June 19, 1920. Latest: Coy's Glen, Ithaca, September 10, 1920. 36 specimens: 14 males, 22 females. Figures 48, 88, 148, 169, on plates in this memoir.

Hydrophoria divisa Meigen

- 1826 *Anthomyia divisa* Meig. Syst. Besch., vol. 5, p. 99, no. 27.
1830 ?*Hydrophoria nymphaeae* Rob.-Desv. Essai Myod., p. 504, no. 2.
1830 ?*Hydrophoria trapae* Rob.-Desv. Essai Myod., p. 505, no. 3.
1830 ?*Hydrophoria nymphaeicola* Rob.-Desv. Essai Myod., p. 506, no. 7.
1830 ?*Zaphne hylemyoidea* Rob.-Desv. Essai Myod., p. 527, no. 1.
1830 ?*Zaphne egerioidea* Rob.-Desv. Essai Myod., p. 527, no. 2.
1835 *Hylemyia dispar* Macq. Hist. Nat. Ins. Dipt., vol. 2, p. 317, no. 7.
1845 *Aricia ambigua* Zett. p. p. Dipt. Scand., vol. 4, p. 1415.
1845 *Anthomyza coronata* Zett. Dipt. Scand., vol. 4, p. 1658, no. 23.
1866 *Hydrophoria brunneifrons* Rond. nec Zett. Atti Soc. Milano, vol. 9, p. 141, no. 4.
1890 ?*Anthomyza dignota* Bident. Ent. Tidskr., vol. 11, p. 199.

Localities.— 1 ♂, Ithaca, May 17, 1913; 1 ♀, no date given; 1 ♂, Herkimer, August 8, 1921 (collected by M. D. Leonard). 3 specimens: 2 males, 1 female.

Hydrophoria flavohalterata Malloch

- 1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 171.

Localities.— 1 ♂, Staten Island, July 23, 1921; 1 ♂, Watchogue, July 14, 1921 (collected by M. D. Leonard). 2 specimens, both males.

Hydrophoria orientalis sp. nov.

Male.—Blackish species, subshining: head black; face, parafacials, and cheeks with whitish pruinescence; antennae and palpi black. Thorax black, thinly covered with grayish pollen; mesonotum, when viewed from above and in front, with a broad median vitta and narrow sublaterals which are indistinct. Abdomen bluish black, with a dense covering of grayish pollen; a blackish brown dorsocentral vitta and well-marked transverse incisures across cephalic margin of terga 3, 4, and 5. Legs entirely blackish; pulvilli tinged. Wings slightly infuscated, yellowish brown; veins yellowish; cross-veins *r-m* and *m-cu* clear. Calyptrae white; halteres pale, whitish.

Eyes separated at narrowest by a distance equal to diameter of anterior ocellus; parafacials, when viewed in profile, narrower throughout their extent than width of third antennal segment; cheeks, in profile, slightly broader than width of third antennal segment, bristles confined to the ventral and caudal margins. Antennae nearly reaching oral margin; second segment short, third segment about three times the length of second. Arista plumose, the longest hairs about equal to width of third antennal segment. Palpi short, somewhat broadened. Thorax with paired acrostical bristles in a regular series, between which are scattered accessory setulae; posthumeral bristle weakly duplicated; pra about half the length of the following bristle; sterno-pleurals, 1:2. Abdomen subcylindrical, with a narrow, linear, dorsocentral bristle; processes of fifth sternum broad and platelike, with numerous hairs and bristles which become stronger apicad, the inner borders clothed with a mat of short, black hairs (similar in character to that of *Pegomyia juvenilis* Stein), the apices of the processes marked by a collection of hairs and short bristles. Fore tibia with one anterodorsal and one posterior bristle. Mid femur with three or four widely spaced proximal posteroventral bristles, and a parallel series of posteroventral setulae along distal half; mid tibia with an anteroventral setula, one anterodorsal, one posterodorsal, and one posteroventral bristle. Hind femur with a series of unequal, widely spaced, anteroventral bristles, and two median posteroventral bristles besides the normal apical setae; hind tibia with one anteroventral, two or three anterodorsal, and two or three posterodorsal bristles. Pulvilli large, elongate; claws small. Lower calyptra distinctly protruded beyond upper. Length, 6 mm.

Locality.—1 ♂, Baiting Hollow, near Riverhead, Long Island, August 18, 1923.

Type.—In the Cornell University collection, Ithaca, New York.

Hydrophoria orientalis most closely resembles *H. uniformis*, from which it can be readily distinguished by the appearance of the processes of the fifth sternum.

Hydrophoria ruralis Meigen

1826 *Anthomyia ruralis* Meig. Syst. Besch., vol. 5, p. 101.

1918 *Hydrophoria subpellucida* Mall. Trans. Amer. Ent. Soc., vol. 44, p. 296. ?

1920 *Hydrophoria subpellucens* Mall. Canad. Ent., vol. 52, p. 253. ?

Locality.—1 ♂, Ithaca, no date given (collected by O. A. Johannsen).

Hydrophoria uniformis Malloch

1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 297.

Records.—Earliest: Lake Ridge, near Ithaca, May 6, 1922. Latest: Cold Spring Harbor, Long Island, September 2, 1921. 93 specimens: 90 males, 3 females. Figures 49, 87, 147, 169, on plates in this memoir.

Genus *Hylemyia* Robineau-Desvoidy

1830 Rob.-Desv. Essai Myod., p. 550, no. 1. *Hylemyia p. p.*

1830 Rob.-Desv. Essai Myod., p. 555, no. 2. ?*Egeria*.

1830 Rob.-Desv. Essai Myod., p. 557, no. 3. *Nerina p. p.*

1830 Rob.-Desv. Essai Myod., p. 558, no. 4. *Adia p. p.*

1830 Rob.-Desv. Essai Myod., p. 559, no. 5. *Phorbia p. p.*

- 1830 Rob.-Desv. Essai Myod., p. 560, no. 6. ?Chloe.
 1830 Rob.-Desv. Essai Myod., p. 571, no. 12. Delia.
 1830 Rob.-Desv. Essai Myod., p. 584, no. 14. Egle p. p.
 1830 Rob.-Desv. Essai Myod., p. 598, no. 1. Pegomyia p. p.
 1835 Macq. Hist. Nat. Ins. Dipt., vol. 2, p. 323, no. 10. Chortophila p. p.
 1838 Zett. Ins. Lapp., p. 660. Anthomyza p. p.
 1845 Zett. Dipt. Scand., vol. 4, p. 1371, no. 134. Aricia p. p.
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 908. Musciosoma.
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 909. Gastrolepta.
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 910. Nevrota.
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 910. Pachystoma.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 94. Leptohylemyia.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 94. Hylemyza.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 95. Crinura.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 96. Delia.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 97. Adia.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 98. Pegohylemyia.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 98. Heterostylus.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 101. Chortophila.
 1920 Mall. Ohio Journ. Sci., vol. 20, p. 270.

The species of *Hylemyia* may be separated according to the following keys:

Males

1. Arista plumose, the longest hairs exceeding in length the width of third antennal segment..2
 Arista pubescent or bare, the longest hairs not equal in length to the width of third antennal segment.....4
2. Eyes separated by a narrow frontal vitta; abdominal terga with dark anterior incisures.
variata Fall.
 Eyes approximate, parafrontals contiguous posteriorly.....3
3. Legs and palpi yellow.....*alcathoe* Walk.
 Legs and palpi black.....*lasciva* Zett.
4. All tibiae yellowish, not infuscated.....5
 All tibiae blackish, rufous, or infuscated.....8
5. Eyes separated by a distance equal to, or exceeding, length of third antennal segment..6
 Eyes separated, at most, by a distance equal to that between posterior ocelli.....7
6. Mid tibia with two or three anteroventral bristles; fore femora infuscated, mid and hind femora yellow; presutural acrosticals lacking, at most one or two setulae.
coenosiaeformis Stein
 Mid tibia with no anteroventral bristles; all femora entirely infuscated; paired, well-developed, presutural acrosticals present.....*latifrontalis* sp. nov.
7. Abdomen entirely yellow, with dense golden pollen; parafacials and cheeks yellowish, with whitish pruinescence; frontal vitta yellowish.....*testacea* Stein
 Abdomen grayish, with yellowish pollen; parafacials and cheeks, in profile, reddish to blackish, with whitish pruinescence; frontal vitta reddish to blackish..*depressa* Stein
8. Third abdominal tergum with posterior lateral angles produced ventrad; processes of fifth sternum with a dense tuft of long, curling bristles; pra absent...*pluvialis* Mall.
 Third abdominal tergum normal, with ventral margin not produced; processes of fifth sternum without dense tufts of long, curling bristles; pra usually present, but may be absent.....9
9. Hind tarsus, except for fifth segment, clothed with longish bristles on dorsal and anterior surfaces; mid tibia clothed with a conspicuous tuft of long bristles on apical half of anterior and dorsal surfaces; mid metatarsus with a similar tuft of long bristles on anterior and dorsal surfaces; hind pulvilli three times as large as mid or fore pulvilli; small species, 4 mm.....*setitarsata* sp. nov.

- Mid and hind tarsi and mid tibia without such bristling; hind pulvilli equal in size to, or smaller than, those of mid or fore legs. 10
10. Hind tibia with an antero- and a posteroventral apical bristle. 11
Hind tibia with only an anteroventral apical bristle, the position for the posterior bristle being filled by a series of fine spinules. 17
11. All femora clothed with long, dense, shaggy hairs; posterior notopleural bristle short, about half length of anterior notopleural bristle. *grandivillosus* sp. nov.
All femora clothed with normal short setulae; posterior notopleural bristle about three-quarters length of anterior bristle. 12
12. Hind femur with a row of short anteroventral bristles, in length not exceeding the width of the femur where they are situated; arista bare or minutely pubescent. 13
Hind femur with a row of long anteroventral bristles, in length exceeding the width of the femur where they are situated; arista distinctly pubescent. 14
13. Eyes separated at narrowest part by a distance equal to three times that between posterior ocelli; third antennal segment twice as long as broad; cross-veins distinctly clouded.
megacephala Mall.
Eyes separated at narrowest part by a distance equal to that between posterior ocelli; third antennal segment nearly as broad as long; cross-veins with only traces of clouding.
arnolitra sp. nov.
14. Pra short, less than half length of the following bristle; hypopygium polished, piceous, shining; wings clear, cross-veins clouded. *pullula* Zett.
Pra long, two-thirds length of the following bristle; hypopygium pollinose; wings yellowish, cross-veins clear. 15
15. Blackish species; parafacials and cheeks, in profile, black velvety; R_1 fused with costa at a point beyond (distad) that opposite $r-m$ cross-vein. *piloseta* Mall.
Grayish species; parafacials and cheeks, in profile, grayish pruinose, with reddish and dark reflections; R_1 fused with costa at a point opposite $r-m$ cross-vein. 16
16. Abdomen with golden pollen; a narrow, brownish, dorsocentral vitta. *inornata* Stein
Abdomen with grayish pollen; dorsocentral vitta composed of broad, darkish, subtriangular fasciae. *setigera* Joh.
17. Mid tibia with a median anteroventral bristle. 18
Mid tibia without an anteroventral bristle. 19
18. Abdomen densely grayish pollinose; a distinct black dorsocentral vitta; hypopygium piceous, polished, shining. *latipennis* Zett.
Abdomen shining, not pollinose; dorsocentral vitta indistinct. *sepia* Meig.
19. Hind tibia with a row of short, closely set, setulose hairs or setulae on anterior and posterior surfaces. 20
Hind tibia with a row or series of hairs or setulae on posterior surface only. 22
20. Grayish species, with whitish pollen; wings white; abdomen with faint traces of a dorsocentral vitta; tibiae slightly reddish. *albula* Fall.
Blackish species; wings grayish, hyaline; abdomen with a black dorsocentral vitta and incisures; tibiae entirely blackish. 21
21. Hind femur distinctly curved, with a short distal series of weak anteroventral bristles; hind tibiae with three or more antero- and posterodorsal bristles besides the normal apical setae. *curvipes* Mall.
Hind femur straight, with a close series of short, stout, uniform bristles along anteroventral surface; hind tibia with only one posterodorsal, one preapical dorsal, and one posterior apical bristle. *unidorsalis* sp. nov.
22. Fore tibia with a strong, curved, posteroventral apical bristle, the tip of which is usually blunt. 23
Fore tibia with a pointed apical posteroventral bristle or setula, the tip of which is sharp. 26
23. Hind tibia with a series of erect setulose hairs along entire length of posteroventral surface. 24
Hind tibia with only a partial series of setulose hairs, not extending entire length of posteroventral surface. 25

24. Mid femur with a row of posteroventral bristles, directed ventrad, along distal half; mid metatarsus with longish hairs on dorsum..... *trichodactyla* Rond.
Mid femur with posteroventral surface bare except for two or three apical setae, directed apicad; mid metatarsus with no longish hairs on dorsum..... *cilicrura* Rond.
25. Mid metatarsus with longish hairs on dorsum; parafacials and cheeks, in profile, reddish; arista distinctly pubescent, the length of the longest hairs being twice that of the second arisal segment..... *innocua* Mall.
Metatarsus with no longish hairs on dorsum; parafacials and cheeks, in profile, grayish, with dark reflections; arista short pubescent, the longest hairs not exceeding the length of the second arisal segment..... *antiqua* Meig.
26. Hind femur with one or more median bristles on posteroventral surface, besides those of basal and apical setae..... 27
Hind femur with posteroventral surface bare, excluding basal and apical setae..... 33
27. Eyes separated by a narrow frontal vitta, parafrontals not contiguous posteriorly.... 29
Eyes closely approximate, parafrontals contiguous posteriorly..... 28
28. Third and fourth abdominal sterna with a series of long bristles on lateral margins; abdominal vitta uniformly broad and stripelike; fifth abdominal sternum without a median tuft of setulae at base of processes..... *spizellae* sp. nov.
Third and fourth abdominal sterna without a noticeable series of bristles on lateral margins; abdominal vitta divided into broad, black, subtriangular spots; fifth abdominal sternum with a median tuft of setulae at base of processes..... *ithacensis* sp. nov.
29. Abdomen infuscated, shining, with dark dorsocentral reflections; palpi short, scarcely longer than third antennal segment, apices flattened..... *laevis* Stein
Abdomen densely pollinose, with a distinct, dark, dorsocentral vitta; palpi slender, filiform, exceeding length of third antennal segment..... 30
30. Hind tibia reddish; abdomen covered with dense yellowish golden pollen; calyptra brownish..... *trivittata* Stein
Hind tibia black; abdomen subshining, with grayish pollen; calyptra whitish..... 31
31. Abdominal vitta consisting of a narrow uniform stripe; arista minutely but distinctly pubescent; fore tibia with a mid-dorsal bristle..... 32
Abdominal vitta composed of broad subtriangular spots on each tergum; arista bare; fore tibia with no mid-dorsal bristle..... *inconspicuus* sp. nov.
32. Inner margin of processes of fifth abdominal sternum with no distinct fringe of fine hairs; mid femur with an interrupted row of bristles on anterior surface... *fugax* Meig.
Inner margin of processes of fifth sternum with a dense fringe of hairs; mid femur with a continuous row of bristles on anterior surface..... *betarum* Lint.
33. Pra long, exceeding half length of the following bristle; a basal tuft of long hairs and bristles on anterior surface of hind femur; sterna 3 and 4 with normal bristling.
brassicae Bouché
Pra short, less than half length of the following bristle; no basal tuft of long hairs and bristles on hind femur; sterna 3 and 4 with a series of conspicuously long bristles along lateral margins..... *florilega* Zett.

Females

1. Arista plumose, the longest hairs being equal in length to second antennal segment... 2
Arista pubescent or bare, the longest hairs not being equal in length to second antennal segment..... 4
2. Palpi yellow; legs yellow except tarsi..... *alcatheae* Walk.
Palpi blackish, infuscated; legs blackish..... 3
3. Bluish gray species; abdomen with a black uniform dorsocentral vitta; all tibiae black.
lasciva Zett.
Yellowish gray species; abdomen with a brown dorsocentral vitta; hind tibiae at times distinctly reddish..... *variata* Fall.
4. Mid and hind femora yellow..... 5
Mid and hind femora blackish..... 7

5. Abdomen yellow.....*testacea* Stein 6
- Abdomen grayish.....6
6. Thorax with scutellum and humeral callosities testaceous; parafacials and cheeks yellowish; mid tibia with one anteroventral bristle.....*depressa* Stein
- Thorax uniformly grayish; parafacials and cheeks grayish; mid tibia with two anteroventral bristles.....*coenosiaeformis* Stein
7. Pra missing.....8
- Pra present.....9
8. Grayish species with yellowish pollen; wings and calyptrae yellowish....*pluvialis* Mall.
- Grayish species with whitish pollen; wings and calyptrae whitish.....*albula* Fall.
9. Hind tibia with stout apical bristles on antero- and posteroventral surfaces.....10
- Hind tibia with a stout anteroventral apical bristle only; that of posteroventral surface wanting, replaced by a fringe of setulae.....15
10. Pra short, less than half length of the following bristle.....*pullula* Zett.
- Pra long, exceeding half length of the following bristle.....11
11. Wings grayish; cross-veins clouded; arista bare or minutely pubescent; cruciates weakly developed or absent.....12
- Wings yellowish; cross-veins clear; arista distinctly pubescent; cruciates strongly developed.....13
12. Third antennal segment tapering distad, nearly twice as long as broad; second aristal segment twice as long as broad.....*megacephala* Mall.
- Third antennal segment nearly as broad as long; second aristal segment nearly as broad as long.....*arnolitra* sp. nov.
13. Blackish species; head, thorax and abdomen blackish, with whitish pollen; thorax with three distinct brownish vittae.....*piloseta* Mall.
- Grayish or cinereous species; parafacials and cheeks silvery gray pruinose; thorax with slight indefinite traces of vittae.....14
14. Abdomen with dense golden pollen.....*inornata* Stein
- Abdomen with yellowish gray pollen.....*setigera* Joh.
15. Mid tibia with a median anteroventral bristle.....16
- Mid tibia without an anteroventral bristle.....19
16. Tarsal segments 3, 4, and 5 of fore legs noticeably broadened.....*latipennis* Zett.
- Tarsal segments of fore legs similar in appearance to those of mid and hind legs.....17
17. Arista distinctly pubescent; cruciate bristles weakly developed or absent; parafacials reddish; sternopleurals, 1:1.....*innocua* Mall.
- Arista bare or minutely pubescent; cruciate bristles strongly developed; parafacials grayish; sternopleurals, 1:2.....18
18. Abdomen fuscous, shining; terminal segments of the ovipositor compressed laterally; length of pra exceeding half that of the following bristle.....*sepia* Meig.
- Abdomen densely grayish pollinose, with dark dorsocentral vitta; terminal segments of ovipositor not noticeably compressed laterally; length of pra less than half that of the following bristle.....*setitarsata* sp. nov.
19. Hind tibia yellowish to reddish; fifth abdominal segment elongate, its length nearly equal to that of the two preceding segments; tergum 5 sparsely clothed with setulae; marginal bristles noticeably reduced in numbers with each succeeding segment....*trivittata* Stein
- Hind tibia blackish; fifth abdominal segment not nearly so long as the two preceding segments; tergum 5 with setulae of the normal number and appearance; marginal bristles normal.....20
20. Fifth abdominal tergum with semi-erect bristle-like setae on disk amongst the normal short appressed setulae.....21
- Fifth abdominal tergum clothed on disk with short appressed setulae only.....24
21. Hind femur with one or more median bristles on posteroventral surface and two preapical bristles on posterior surface; arista pubescent, the longest hairs exceeding in length the diameter at base of arista.....22
- Hind femur with posteroventral surface bare except for a few apical and basal bristles; with one preapical bristle on posterior surface; arista minutely pubescent, the longest hairs not so long as the diameter at base of arista.....23

22. Mid femur with an uninterrupted row of bristles on anterior surface; thorax with weak presutural acrostical bristles or an irregular series of setulose hairs.... *betarum* Lint.
Mid femur with an interrupted row of bristles on anterior surface; presutural acrostical bristles stoutly developed..... *fugax* Meig.
23. Pra half the length of the following bristle; mid tibia with two posterodorsal bristles.
ithacensis sp. nov.
Pra less than half the length of the following bristle; mid tibia with one posterodorsal bristle..... *spizellae* sp. nov.
24. Abdomen fuscous, shining or subshining, with only a trace of grayish pollen; parafacials and cheeks reddish; proboscis slender, cylindrical, fuscous, and highly polished.
laevis Stein
Abdomen densely grayish pollinose, with a trace of a dorsocentral vitta; parafacials and cheeks grayish; proboscis normally thickened, not highly polished..... 25
25. Pra long, exceeding half length of the following bristle; fore femur with a short series of longish hairs on anterior surface..... *brassicae* Bouché
Pra short, less than half length of the following bristle; fore femur with no longish median hairs on anterior surface..... 26
26. Parafacials, in profile, prominent, the breadth at base of antennae equal to, or exceeding, width of third antennal segment..... *antiqua* Meig.
Parafacials, in profile, not prominent, the breadth at base of antennae not equal to width of third antennal segment..... 27
27. Hind tibia with a preapical setula on posteroventral surface..... *cilicrura* Rond.
Hind tibia without a preapical setula on posteroventral surface..... *trichodactyla* Rond.

Hylemyia albula Fallén

- 1824 *Musca albula* Fall. Musc., p. 74, no. 83.
1845 *Aricia arenosa* Zett. Dipt. Scand., vol. 4, p. 1511, no. 1610.
1903 ?*Chirosia capito* Coq. Proc. U. S. Nat. Mus., vol. 25, p. 123.

Localities.—1 ♂, Ontario Beach, North Fair Haven, July 7, 1922 (collected by L. S. West); 2 ♀, Cold Spring Harbor, Long Island, September 5, 1920 (collected by J. Bequaert and E. Burns); 10 ♂, 7 ♀, Baiting Hollow, near Riverhead, Long Island, September 3, 1923. 20 specimens: 11 males, 9 females.

Hylemyia alcaethoe Walker

- 1849 *Anthomyia alcaethoe* Walk. List Dipt. Brit. Mus., part 4, p. 937.
1884 *Hylemyia flavicaudata* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 299.
1898 *Hylemyia strigata* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 211.
1916 *Hylemyia tenax* Joh. Trans. Amer. Ent. Soc., vol. 42, p. 388.

Records.—Earliest: Lakeville, Long Island, May 16, 1921. Latest: Buttermilk, Ithaca, September 25, 1921. 200 specimens. Figures 14, 67, 103, on plates in this memoir.

Hylemyia antiqua Meigen

- 1826 *Anthomyia antiqua* Meig. Syst. Besch., vol. 5, p. 166, no. 145.
1830 *Anthomyia ceparum* Meig. Syst. Besch., vol. 6, p. 376, no. 217.
1844 *Musca liturariae* Ratzeb. Forstins., vol. 3, p. 170, no. 1.
1851 ?*Anthomyia caepicola* Rob.-Desv. Guér.-Mén., Rev. et Mag. Zool., ser. 2, vol. 3, p. 234, no. 1.
1882-83 *Chortophila cinerea* Meade nec Fall. Ent. Mo. Mag., vol. 19, p. 147.
1882-83 *Phorbia cepetorum* Meade. Ent. Mo. Mag., vol. 19, p. 218.
1893 *Anthomyia angustifrons* Strobl nec Meig. Verh. Zool.-Bot. Ges. Wien, vol. 43, p. 259.

Specimens reared by Dr. J. L. Buys at Williamson during August, 1916, and by S. W. Frost at Durandville during July, 1917. 56 specimens: 41 males, 15 females. Figures 1, 51, 98, on plates in this memoir.

Hylemyia arnolitra sp. nov.

Male.—Blackish species. Head blackish; parafrontals and parafacials of dense grayish velvet with whitish pruinescence; cheeks reddish brown, with whitish pruinescence. Antennae blackish, first and second segments covered with dense grayish velvet; third arisal segment slightly reddish brown beyond basal swelling. Palpi black. Thorax blackish, with slight cinereous pollen; viewed from above and behind, the mesonotum with traces of a median vitta, the sides of the disk between the alar callosities and the transverse suture with a noticeable black patch; also, a noticeable dark fascia on each side behind posthumeral bristles, humeral callosities with lighter, grayish pollen. Abdomen, viewed from above and behind, with dense grayish pollen and a distinct, linear, black, dorsocentral vitta; anterior margin of each tergum with blackish uniform incisures; hypopygium not so densely pollinose, subshining. Legs black. Wings clear; veins brownish; *r-m* and *m-cu* cross-veins faintly clouded. Calyptrae white. Halteres yellow.

Eyes separated, at narrowest part, by a distance equal to that between posterior ocelli. Parafrontals and parafacials, in profile, prominent, at base of antennae equal in width to breadth of third antennal segment, parafacials rapidly receding ventrad to narrower proportions. Antennae short, the third antennal segment nearly as broad as long; arista minutely pubescent, noticeably swollen at base. Acrosticals distinct, irregularly placed in two closely adjacent rows. Pra short. Sternopleurals, 2:2. Abdomen cylindrical, longer than thorax; terga with strong lateral bristles on disk, besides the usual marginal bristles. Second sternum with a noticeably stronger growth of bristles and setae than remaining sterna. Hypopygium small and inconspicuous, largely inclosed within fifth tergum; processes of fifth sternum small and short, apices and outer border bare, inner area clothed throughout with setulae, inner margins interrupted by a median prominence. Fore tibia with one median and one weak apical posteroventral bristle. Mid femur with two or three short, stout, median anteroventral bristles, and a proximal row of similar posterodorsal bristles; mid tibia with one anterodorsal, two posterodorsal, and two or three posteroventral bristles, the last-named bristles and the upper posterodorsal bristle reduced and appearing as setulae. Hind femur with a row of short, stout, anteroventral bristles, the longest not exceeding the breadth of the femur where they are situated; also, an interrupted series of short posteroventral bristles; hind tibia with three weak anteroventral, five diverse anterodorsal, and three posterodorsal bristles; two or three setulae on posteroventral surface; strong postero- and anteroventral apical bristles. Tarsi laterally compressed; pulvilli and claws noticeably long. Costal thorn small. Calyptrae subequal. Length, 5.5–7.5 mm.

Female.—Similar to male except for the following characters: Abdomen with a broad, brownish, dorsocentral vitta, tapering caudad, and incisures that are not well defined. Frontal vitta blackish, with cruciates minutely developed. Length of pra exceeding half that of the following bristle. Bristles and setae of second abdominal sternum similar to those of remaining sterna. Legs with bristles more strongly developed than in male. Fore tibia with one dorsal, one posterior, and two posteroventral bristles, the apical posteroventral bristle well developed. Hind femur with three or four bristles dispersed along antero- and posteroventral surfaces; hind tibia with no setulae on posterior surface. Tarsal claws and pulvilli of moderate size, shorter than in male. Costal thorn distinct; cross-veins distinctly clouded. Length, 6 mm.

Localities.—1 ♂, Hempstead, Long Island, April 10, 1921; 3 ♂, April 12, 1921; 1 ♀, Ithaca, May 8, 1915. 5 specimens: 4 males, 1 female. Figures 16, 60, 113, on plates in this memoir.

Type.—In the Cornell University collection, Ithaca, New York.

Allotype.—In author's collection.

Paratype.—In the United States National Museum collection, Washington, D. C.

In the male specimens before the writer, the distance between the eyes varies, but in no case is it less than the distance between the posterior ocelli. Similarly, the length of the prealar bristle varies, but in no case does the length exceed two-thirds that of the following bristle.

Hylemyia betarum Lintner1882 *Chortophila betarum* Lint. 1st Rept. State Ent., p. 208-209.1898 *Hylemyia substriata* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 233, no. 2.

Male.—Blackish species; head blackish, with whitish pruinescence on parafrontals and parafacials. Frontal vitta black, opaque. Antennae and palpi blackish. Thorax black, shining, with a greenish gray hue; viewed from behind, the humeral angles and sides of disk of mesonotum with apparently light grayish pollen; with one broad median vitta and two narrower sublaterals which gradually become indistinct caudad owing to the infuscation of the mesonotum. Abdomen blackish, shining (the dorsal surface of terga 2 and 3 largely greased), of a greenish gray hue; with an uniformly narrow mid-dorsal vitta apparent; terminal segments (numbers 3, 4, and 5), including hypopygium, thickened when viewed in profile. Legs black. Wings infuscated; (halteres missing from the specimens); calyptrae tinged.

Head similar to that of *substriata* Stein; eyes separated at the narrowest by a distance slightly greater than diameter of anterior ocellus; frontal vitta continuous between the eyes, narrowly separating the parafrontals caudad, enlarging into a broad triangular vitta cephalad; cruciate bristles present. Parafacials and cheeks, in profile, not noticeably broad nor prominent; ventral margin of cheeks with comparatively long, conspicuous bristles, directed cephalad and dorsad. Arista distinctly short pubescent, even to the apex, the longest hairs slightly longer than diameter at base of arista. Palpi linear, narrow. Thorax with two pairs of presutural acrostical bristles, between which are two irregular series of short hairs; pra short, less than half the length of the following bristle; posthumeral bristle not duplicated. Abdomen with stiff, erect hairs and bristles; processes of fifth sternum with a fringe of erect hairs the entire length of the inner margin. Legs missing in the specimens, except for mid femur and tibia. Mid femur with an uninterrupted row of bristles on anterior surface; with an interrupted series of setulae on anteroventral surface, the basal setulae being longer; posteroventral surface with two long, conspicuous bristles basad; mid tibia with one anterodorsal, two posterodorsal, and two posteroventral bristles. Wings with cross-vein *m-cu* slightly sinuate; lower calyptra smaller than upper, not protruding. Length, 5-6 mm.

Female.—Similar to male except that the color is lighter, and the thorax is not so profusely infuscated. Cruciate bristles present; frontal vitta reddish cephalad. Thorax with or without presutural acrostical bristles, with three irregular series of hairs in the line of the acrosticals. Abdomen with an indistinct mid-dorsal fascia. Wings hyaline; veins yellowish. Fore tibia with one median dorsal and one median posteroventral bristle. Mid femur with one strong anteroventral bristle basad. Hind femur with a series of anteroventral bristles for its entire length; with an apical posteroventral bristle, and two posteroventral bristles on basal half; hind tibia with three posterodorsal, six anterodorsal, and one anteroventral bristle. Fifth tergum of abdomen with erect bristles on discal surface. Length, 5-6 mm.

Reared from beet leaves, New York, 2 males, 6 females.

Localities.—4 ♂, Ithaca, May 13, 1913; 1 ♀, June 26, 1915; 2 ♂, July 9, 1920; 1 ♀, May 2, 1920; 3 ♀, May 23, 1920; 1 ♀, Buttermilk, Ithaca, July 18, 1920; 1 ♂, Lake Ridge, near Ithaca, April 30, 1922; 4 ♂, Hicksville, Long Island, April 21, 1921; 1 ♂, Valley Stream, Long Island, April 27, 1921; 1 ♀, Ithaca, July 30, 1920 (reared from mangold leaves). 19 specimens: 12 males, 7 females. Figures 12, 69, 109, on plates in this memoir.

Through the courtesy of Mr. D. B. Young, of the State Museum, the writer was enabled to examine in detail the types of *Hylemyia betarum* Lintner. He finds that this species is identical with *Hylemyia substriata* Stein, and most closely resembles *Hylemyia fugax* Meigen.

According to Malloch, the male of *substriata* can be distinguished from that of *fugax* by the possession of a fringe of hairs along the inner margin of each process of the fifth sternum (characters which *substriata* and *betarum* bear in common), as well as by its comparatively smaller size.

The female of *betarum* agrees in every particular with that of the writer's specimen of *substriata*, both series showing a variation in the development of the presutural acrostical bristles which makes it difficult to distinguish them from the female of *fugax*.

Stein (1919) lists *substriata* as a synonym of *fugax*, with a question mark.

Hylemyia brassicae Bouché

- 1824 *Musca floralis* Fall. *p. p.* Musc., p. 71, no. 76.
 1826 *Anthomyia floralis* Meig. Syst. Besch., vol. 5, p. 165, no. 143.
 1833 *Anthomyia brassicae* Bouché. Naturg. Gart. Ins., p. 131, no. 2.
 1835 *Chortophila floccosa* Macq. Hist. Nat. Ins. Dipt., vol. 2, p. 326.
 1835 *Anthomyia raphani* Harris. Cat. Animals Mass., p. 80.
 1845 *Aricia villipes* Zett. Dipt. Scand., vol. 4, p. 1456, no. 67.
 1884 *Chortophila appendiculata* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 278, no. 3.
 1904 *Pegomyia bucculenta* Coq. Proc. Ent. Soc. Wash., vol. 6, p. 188.

Records.—Earliest: Wantagh, Long Island, April 7, 1921. Latest: Ithaca, September 9, 1920. 200 specimens. Figures 2, 53, 99, on plates in this memoir.

The females of *Hylemyia brassicae* that have been collected in the woods appear to differ in color from those reared or collected around vegetable fields. The former are almost bluish or steel gray in shade, and the thorax is distinctly marked by brownish vittae. The specimens collected around vegetable fields are cinereous in shade, with brownish markings on the thorax.

Hylemyia cilicrura Rondani

- 1826 *Anthomyia aestiva* Meig. *p. p.* Syst. Besch., vol. 5, p. 169, no. 149, ♀.
 1826 *Anthomyia platyura* Meig. *p. p.* Syst. Besch., vol. 5, p. 171, no. 152.
 1830 *Anthomyia diversa* Wied. Ausser. Zweifl. Ins., vol. 2, p. 436.
 1835 ?*Anthomyia cana* Macq. Hist. Nat. Ins. Dipt., vol. 2, p. 340.
 1845 *Aricia florilega* Zett. *p. p.* Dipt. Scand., vol. 4, p. 1555.
 1849 *Anthomyia tyana* Walk. List Dipt. Brit. Mus., part 4, p. 945.
 1849 *Anthomyia serga* Walk. List Dipt. Brit. Mus., part 4, p. 947.
 1849 *Anthomyia tinia* Walk. List Dipt. Brit. Mus., part 4, p. 949.
 1849 *Anthomyia perrima* Walk. List Dipt. Brit. Mus., part 4, p. 950.
 1849 *Anthomyia viana* Walk. List Dipt. Brit. Mus., part 4, p. 951.
 1849 *Anthomyia corelia* Walk. List Dipt. Brit. Mus., part 4, p. 953.
 1849 *Eriphia marginata* Walk. List Dipt. Brit. Mus., part 4, p. 964.
 1849 *Dialyta cupreifrons* Walk. List Dipt. Brit. Mus., part 4, p. 966.
 1855 *Hylemyia deceptiva* Fitch. Trans. New York Agr. Soc., vol. 15, p. 533.
 1855 *Anthomyia zae* Riley. 1st Rept. U. S. Ent. Comm., p. 285.
 1866 *Chortophila cilicrura* Rond. Atti Soc. Ital. Sci. Nat., vol. 9, p. 165.
 1868 *Anthomyia lanicrus* Thoms. Dipt. Eug. Res., p. 556.
 1868 *Anthomyia platygaster* Thoms. Dipt. Eug. Res., p. 556.
 1883 *Aricia coronata* Holmgr. Ent. Tidskr., vol. 4, p. 171, no. 29.
 1884 *Homalomyia rupecula* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 285, no. 5.
 1884 *Anthomyia rubifrons* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 297, no. 3.
 1885 *Anthomyia radicum* var. *calopteni* Riley. 9th Missouri Rept., p. 92.

Records.—Earliest: Ithaca, March 29, 1920. Latest: Ithaca, September 12, 1921. 200 specimens. Figures 4, 52, 107, on plates in this memoir.

Until recently *Hylemyia cilicrura* Rond. has been confused with *H. fusciceps* Zett. According to Stein (1916), however, *cilicrura* Rond. and *fusciceps* Zett. are two distinct species.

Hylemyia coenosiaeformis Stein

1904 Stein. Ann. Mus. Nat. Hung., vol. 2, p. 477, no. 2.

Localities.—1 ♀, Ithaca, June 5, 1915; 1 ♂, Renwick, Ithaca, August 8, 1920; 1 ♂, Ithaca, August 20, 1915; 1 ♂, Old Forge, First Lake, August 23, 1922 (collected by M. D. Leonard); 1 ♂, Mount Whiteface (alt. 2000–4000 ft.), August 22–24, 1916. 5 specimens: 4 males, 1 female. Figures 9, 57, 104, on plates in this memoir.

Hylemyia curvipes Malloch

1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 316.

Records.—Earliest: Ithaca, May 1, 1918. Latest: Montezuma Marshes, Cayuga, July 1, 1920. 31 specimens, all males. Figures 6, 55, 102, on plates in this memoir.

Hylemyia curvipes is commonly collected near the ground in the gorges of Ithaca and its vicinity, during May and June. The female of the species has entirely eluded constant efforts to capture it.

Hylemyia depressa Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 214, no. 6.

Localities.—2 ♂, Durlandville, June 27, 1917 (collected by S. W. Frost); 4 ♂, 3 ♀, Florida, New York, June 30, 1917 (collected by S. W. Frost); 5 ♂, Owego, July 16, 1921 (collected by L. S. West); 16 ♂, 7 ♀, Taughannock Falls (near Ithaca), July 17, 1920; 1 ♂, 1 ♀, Ithaca, August 23, 1921. 39 specimens: 28 males, 11 females. Figures 20, 65, 100, on plates in this memoir.

The infuscation of the femora, palpi, parafacials, cheeks, and frontal vitta varies considerably in the specimens listed above. The *pra* may be present or absent. The hypopygium and the ovipositor are exactly alike in *Hylemyia depressa* and *H. testacea*.

Hylemyia florilega Zetterstedt

1845 *Aricia florilega* Zett. p. p. Dipt. Scand., vol. 4, p. 1555, no. 169.

1898 *Hylemyia planipalpis* Stein p. p. Berl. Ent. Ztschr., (1897) vol. 42, p. 234.

1918 *Hylemyia angustiventris* Mall. Trans. Amer. Ent. Soc., vol. 44, p. 315.

Localities.—1 ♂, Ithaca, July 1, 1915; 1 ♂, July 24, 1903. Figures 160, 161, 162, on plates in this memoir.

The writer has a male specimen determined by Stein as *Chortophila florilega* Zett., which in appearance closely resembles the two male specimens mentioned above. All, including *Hylemyia angustiventris* Mall., agree in the following points: the third and fourth abdominal sterna possess a few conspicuous, long bristles, directed ventrad, which are arranged in a series along the lateral margins; the thorax has three faint but distinct narrow vittae; the abdomen possesses a comparatively broad, uniform, dorsocentral vitta; the arista is minutely but distinctly pubescent; the face is noticeably concave. In addition, these specimens may be

recognized by the width of the third and fourth abdominal sterna, which are nearly as long as they are broad.

Dr. J. M. Aldrich has informed the writer that there are two distinct species amongst three of the type specimens of *Hylemyia planipalpis* Stein. Two of the types, a male and a female, agree exactly with the description (Stein, 1898), and resemble *H. brassicae* Bouché. The male of this pair differs from the male of *brassicae* in having a proximal row of short, uniform bristles on the posteroventral surface of the hind femur, a feature which is lacking in *brassicae*, and in having no noticeable tuft of hairs and bristles at the base of the anterior surface of the hind femur, such as is conspicuously present in *brassicae*. The female type specimen differs from the female of *brassicae* in having the palpi conspicuously broadened toward the apices, a variable character in a series of eleven females of this species. The third type specimen, a male, resembles very closely the specimen determined by Stein as *florilega* Zett., and contradicts the description of *planipalpis* in having the palpi filiform and not broadened at the apices, and in having the prealar bristle short, less than half the length of the following bristle, as well as possessing the characters already mentioned for *florilega* but not noted in the description of that species.

Hylemyia planipalpis Stein is referred to here in the sense which has for its support the two types (Moscow, Idaho) agreeing with the description. The other type specimen (Craig's Mountain, Idaho), which disagrees with the description, is referred to as synonymous with *florilega* Zett.

Hylemyia fugax Meigen

1826 *Anthomyia fugax* Meig. p. p. Syst. Besch., vol. 5, p. 174.

1838 *Anthomyza striolata* Zett. nec Fall. p. p. Ins. Lapp., p. 684, no. 103.

1866 *Chortophila pudica* Rond. Atti Soc. Milano, vol. 9, p. 173, no. 31.

1920 *Hylemyia denticauda* Mall. Ohio Journ. Sci., vol. 20, p. 281.

Localities.—1 ♀, Coy's Glen, Ithaca, May 23, 1922; 2 ♀, McLean Bogs (near Ithaca), September 11, 1920; 1 ♀, Ithaca, October. 4 specimens, all females. Figure 175 on Plate XVI.

Hylemyia fugax Meig. most closely resembles *H. betarum* Lint. Malloch (1920 b) states that the male of *fugax* is distinguished from that of *substriata* Stein (= *betarum* Lint.) in having the processes of the fifth sternum broader and with hardly any fine hairs along the glossy inner margin. *H. fugax* differs also from *betarum* in being larger, and in the structure of the genitalia, as is shown by Malloch's (1920 b) figures of *denticauda*.

The females listed above are distinguished from the female of *betarum* in possessing one or more pairs of stout, presutural, acrostical bristles, in having an interrupted row of bristles on the anterior surface of the middle femur, and in being of larger size.

Hylemyia grandivillosus sp. nov.

Male.—Blackish species, subshining. Head black; parafrontals, parafacials, and cheeks silvery gray pruinose, velvety, with dark reflections; first and second antennal segments slightly pruinose. Frontal vitta, when viewed from in front, with whitish pollen. Antennae

blackish; arista beyond basal thickening, brownish. Palpi black. Thorax, viewed from above and behind, blackish, with grayish pollen; a trace of a median vitta; humeral region with lighter grayish pollen. Abdomen, viewed from above and behind, with fine whitish pollen; a uniformly narrow, blackish, dorsocentral vitta; terga with a narrow blackish anterior incisure; hypopygium with cinereous pollen, the caudal half of the basal segment piceous, polished, shining. Legs black, subshining. Pulvilli infuscated. Wings grayish brown; veins brownish; *r-m* cross-vein with slight traces of infuscation. Calyptrae white. Halteres yellowish.

Eyes separated, at narrowest part, by a distance slightly greater than that between posterior ocelli; parafrontals contiguous; frontal bristles numerous, extending as far as ocelli; vertical bristles well developed, equal in size to anterior pair of ocellar bristles. Parafrontals and parafacials, in profile, prominent, at base of antennae equal in width to the breadth of third antennal segment, the parafacials receding gradually ventrad; cheeks along ventral border invaded by several upturned setae. Vibrissal, oral, and caudal regions of head clothed with numerous black bristles and setae. Third antennal segment one and one-half times as long as broad; arista almost bare. Thorax with numerous accessory setulae; acrosticals represented by two irregular, closely adjacent rows of setulae; posthumeral bristles duplicated; pra twice length of posterior notopleural bristle, the latter noticeably short and stout. Sternopleurals, 2:3. Abdomen conical, equal in length to thorax; the setae and marginal bristles on mid-dorsal region appressed and considerably reduced in size and length; lateral bristles of discal and marginal regions of terga strong and erect; ventral region of abdomen clothed with dense, fine, black setae; processes of fifth sternum clothed with numerous fine setae. Legs with the femora exceptionally hairy, especially the fore femora. Fore tibia with one weak dorsal seta and two posteroventral bristles. Mid femur with dense, fine setae and bristles on proximal half of ventral and posteroventral surfaces; an oblique row of four preapical bristles on posterior surface; mid tibia with one anterodorsal, two posterodorsal, and four posteroventral bristles. Hind femur with a complete row of short anteroventral bristles, the length of each not exceeding the breadth of the femur where it is situated; an interrupted row of similar posteroventral bristles; hind tibia with five anteroventral, five or six diverse anterodorsal, and five or six diverse posterodorsal bristles; posterior surface with a median series of five or six setulae. Tarsi with stout claws. Costal thorn very small and inconspicuous; *m-cu* cross-vein sinuous. Upper calyptrae covering the lower. Length, 8 mm.

Localities.—1 ♂, Hempstead, Long Island, April 10, 1921.

Type.—In author's collection.

Hylemyia inconspicuus sp. nov.

Male.—Black, with grayish drab pruinescence. Head, with parafrontals, parafacials, and cheeks, dark brown, with dense whitish pruinescence. Antennae and palpi black. Thorax blackish; viewed from above and behind, with three distinct vittae, the median one broad, the sublaterals narrow; presutural region of mesonotum with light whitish pollen. Abdomen drab grayish, whitish pruinose; dorsum with a broad, black, subtriangular spot on each tergum; hypopygium brownish, subshining. Legs black. Wings clear; veins brownish. Calyptrae whitish. Halteres yellow.

Eyes separated, at narrowest part, by a distance equal to diameter of anterior ocellus; anterior pair of ocellar bristles well developed, equal in length to the longest parafrontal bristles. Parafacials and cheeks, in profile, narrow. Antennae short, third segment twice as long as second; arista slightly swollen at base. Thorax with numerous accessory setulae; acrosticals distinct and irregularly paired, with three or four pairs of presutural acrosticals. Pra short, a little less than half length of the following bristle. Sternopleurals, 1:2, with a third bristle apparent which is considerably weaker than the upper two. Abdomen clothed with robust black setulae and bristles; processes of fifth sternum not attenuated apicad, but short and stout, with numerous fine apical setulae on inner and outer margins. Fore tibia with a median bristle and a fine pointed apical bristle on posteroventral surface. Mid femur with a series of moderately developed anteroventral bristles along proximal half; posteroventral bristles long and strong, confined also to proximal half; mid tibia with one anterodorsal, two posterodorsal, and two posteroventral bristles. Hind femur with a distinct row of posteroventral bristles,

the apical bristles weak and directed apicad, and with a complete row of anteroventral bristles, which increase in size apicad; hind tibia with five anteroventral, five anterodorsal, and three posterodorsal bristles; a series of short setulae along proximal half of posterior surface. Costal thorn small; second section of vein M_{1+2} about twice as long as third section. Upper calyptia covering the lower. Length, 4 mm.

Locality.—1 ♂, Hempstead, Long Island, April 10, 1921.

Type.—In author's collection.

Hylemyia inconspicuus resembles *H. cilicrura* Rond., but can be distinguished from it by the following characters: the posterior apical bristle of the fore tibia is weak and pointed; there is a posteroventral row of bristles on the hind femur; and there is a partial series of posteroventral hairs on the hind tibia.

Hylemyia innocua Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 186.

Localities.—1 ♂, Lake Ridge (near Ithaca), July 1, 1920; 5 ♂, 3 ♀, McLean Bogs (near Ithaca), July 3, 1920; 1 ♂, Gloversville (collected by Dr. C. P. Alexander). 10 specimens: 7 males, 3 females. Figures 5, 56, 105, 176, on plates in this memoir.

Hylemyia inornata Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 220.

Localities.—1 ♂, Coy's Glen, Ithaca, May 14, 1922; 1 ♀, May 22, 1922; 1 ♀, May 23, 1922; 1 ♂, 1 ♀, Ithaca, May 28, 1922; 1 ♂, Ithaca, 19—. 6 specimens: 3 males, 3 females. Figures 13, 61, 110, on plates in this memoir.

Hylemyia inornata Stein belongs to the group of closely allied forms including *marginata* Stein, *marginella* Mall., *spinilamellata* Mall., *piloseta* Mall., and *setigera* Joh. It most closely resembles *setigera*, from which it may be separated by the following characters: the conspicuous golden pollen of the abdomen; the distinct narrow dorsocentral vitta of the abdomen in the male; the appearance of the male genitalia.

Hylemyia ithacensis sp. nov.

Male.—Blackish species, with a bluish tinge. Head black; parafrontals, parafacials, and cheeks silvery gray pruinose, velvety, with dark reflections. Antennae and palpi blackish. Thorax blackish; viewed from above and behind, with a black, uniform, median vitta, and broad lateral blackish markings on each side of the disk; humeral and notopleural callosities with lighter grayish pollen; scutellum blackish. Abdomen, viewed from above and behind, with whitish pollen; a black dorsocentral vitta, which is divided into blackish, subtriangular spots, the latter merging anteriorly into the black tergal incisures. Legs black. Wings slightly infuscated; veins brownish. Calyptrae white. Halteres yellow.

Eyes separated, at narrowest part, by a distance not greater than diameter of anterior ocellus; parafrontals contiguous. Parafacials narrow in profile, as in *cilicrura*; cheeks invaded along ventral border by several setulae which reach almost to ventral margin of eye. On inner surface of second antennal segment, a dorsal pair of tubercles and one or more ventral tubercles; third antennal segment expanded somewhat from base, about equal in length to twice length of second antennal segment; arista almost bare; second segment nearly twice as long as wide. Thorax with numerous accessory setulae; three or four pairs of well-developed presutural acrosticals; postsutural acrosticals arranged in pairs, and weaker than the presutural; post-humeral bristles duplicated. Pra short, less than half length of the following bristle. Sterno-pleurals, 2 : 3, the lowest bristle of each group appearing considerably weaker and shorter than

the upper ones. Abdomen shorter than length of thorax, somewhat depressed, slightly tapering at apex; processes of fifth sternum conspicuous, piceous, polished, shining; each process divided broadly into an anterior and a posterior arm; the anterior arms broad and flat, plate-like, surmounted by an apical tuft of setulae, and lying adjacent to one another in the mid-ventral plane in a pendent position; the posterior arms attenuated, rodlike, surmounted by a strong apical hook, and lying separated from one another in a horizontal position; the extended ventral margin of each process fringed with long, fine setulae directed mesad. Fore tibia with one posteroventral bristle and a pointed, weak, posteroventral apical setula. Mid femur with a proximal row of posteroventral bristles; mid tibia with one anterodorsal, one posterodorsal, and one posteroventral bristle, all very weak. Hind femur with a complete row of anteroventral bristles and an interrupted row of weaker posteroventral bristles; hind tibia with four anteroventral setulae, six or seven diverse anterodorsal and three posterodorsal bristles, and a median series of four or five setulae on posterior surface; no posteroventral apical bristle. Pulvilli and claws of equal size on all tarsi. Costal thorn minute, scarcely separated from costal setulae. Upper calyptra covering the lower. Length, 4 mm.

Female.—Similar to male except for the following characters: Abdomen, viewed from above and behind, with light grayish pollen; dorsocentral vitta tapering caudad; terga with narrow dark anterior incisures; fifth abdominal tergum with a few erect bristles on discal area, besides the normal setulae. Wings clear. Eyes separated by a broad front, as broad as long; cruciates present; cheeks smooth directly beneath ventral margin of eye, with slight, if any, encroachment of setulae toward the eye's margin. Second arisal segment with a slight reddish infuscation, with no sensory tubercles on inner surface as in the male; arista somewhat thickened at base. Thorax with one pair of strongly developed presutural acrosticals, besides two weaker pairs. Pra fully half as long as the following bristle. Sternopleurals, 2:1, the latter possessing two weaker setae ventrad, the former with the ventral bristle weak. Abdomen broadly ovoid, the third tergum, viewed from above, equal in width to three-quarters the length of abdomen. Fore tibia with one dorsal and one or two posteroventral bristles. Mid femur with a few anteroventral bristles toward base; posteroventral bristles weaker than in male; mid tibia with one anterodorsal, two posterodorsal, and two posteroventral bristles, all stronger than in male. Hind femur with a distal row of four or five anteroventral bristles, and a basal ventral bristle; posteroventral surface bare except for one or two apical setae; hind tibiae with no series of setulae on the posterior surface. Length, 4–5 mm.

Localities.—1 ♂, Ithaca, April 24, 1923; 1 ♀, May 26, 1907; 1 ♀, Lake Ridge (near Ithaca), April 30, 1922; 1 ♂, May 6, 1922; 1 ♂, 1 ♀, Ithaca, June (collected by R. C. Shannon). 6 specimens: 5 males, 1 female. Figures 7, 63, 112, on plates in this memoir.

Type.—In the Cornell University collection, Ithaca, New York.

Paratype.—In the United States National Museum collection, Washington, D. C.

Hylemyia laevis Stein

1898 *Chortophila laevis* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 231.

Records.—Earliest: Ithaca, June 29, 1920. Latest: Coy's Glen, Ithaca, September 9, 1920. 122 specimens: 84 males, 38 females. Figures 15, 66, 117, 171, on plates in this memoir.

Hylemyia lasciva Zetterstedt

1826 *Anthomyia partita* Meig. Syst. Besch., vol. 5, p. 100.

1826 *Anthomyia asella* Meig. Syst. Besch., vol. 5, p. 110.

1838 *Anthomyza lasciva* Zett. Ins. Lapp., p. 666.

Localities.—3 ♂, 1 ♀, Lake Ridge (near Ithaca), May 6, 1922; 1 ♂, April 4, 1922; 1 ♂, Ithaca, May 20, 1920 (collected by R. C. Shannon); 1 ♀, July 2, 1902; 1 ♀, Ringwood (near Ithaca), June 26, 1920; 1 ♀, Old Forge, First Lake, August 23, 1922 (collected by M. D. Leonard). 9 specimens: 5 males, 4 females. Figures 10, 59, 115, 178, on plates in this memoir.

Hylemyia latifrontalis sp. nov.

Male.—Blackish species, with dense drab pollen. Head reddish; parafrontals, parafacials, and cheeks, yellowish gray pruinose. Frontal vitta reddish, occipital region grayish opaque. Antennae black, with a tinge of reddish along distal border of second segment. Palpi blackish, reddish basad; proboscis black. Thorax grayish drab, with brownish pollen on mesonotum; when viewed from above and behind, with three dark brownish vittae. Abdomen pollinose; when viewed from above and behind, with traces of a dark dorsocentral fascia; hypopygium pollinose. All femora entirely blackish; tibiae yellowish, the fore pair slightly infuscated. Tarsi black. Pulvilli infuscated. Wings slightly tinged with yellow; veins yellowish; cross-veins slightly clouded. Calyptrae tinged. Halteres pale yellowish.

Eyes separated by a distance equal to one-third width of head. Frontal vitta broad, with margins subparallel; cruciate bristles well developed. Parafrontals and parafacials, in profile, narrow, at base of antennae somewhat broadened, equal in breadth to width of third antennal segment. Antennae long and slender, reaching nearly to level of oral margin; third antennal segment three times as long as wide; arista pubescent, as in *betarum*, but little thickened basad. Thorax with but few accessory setulae; acrosticals paired irregularly into two rows, with one presutural pair more developed than the others. Pra as long as posterior notopleural bristle. Sternopleurals, 2 : 2, the lower anterior bristle weaker and shorter than the others. Abdomen short, broad, depressed; terga 3, 4, and 5 with transverse rows of discal bristles besides the marginals; hypopygium slightly thickened when viewed in profile; processes of fifth sternum fringed on inner margins with a few black hairs. Fore tibia with a strong mid-dorsal and a strong posteroventral bristle. Mid femur with an entire series of strong posteroventral bristles; mid tibia with one anterodorsal, two posterodorsal, and two posteroventral bristles. Hind femur with a complete series of anteroventral bristles; posteroventral surface with a series of weaker bristles along distal half, the apical bristle noticeably stronger than the others; proximal half with a long, strong bristle; hind tibia with one anteroventral, four anterodorsal, and three posterodorsal bristles, the posterior surface with one median setula in the type; if there is a series of setulae, such setulae are so appressed as to be indistinguishable from the setulae clothing the tibiae. Costal thorn prominent, distal parts of veins R_{4+5} and M_{1+2} subparallel; *m-cu* cross-vein slightly sinuous. Upper calyptrae covering the lower. Length, 5 mm.

Localities.—1 ♂, Wading River, Long Island, September 3, 1919; 1 ♂, Cold Spring Harbor, Long Island, September 4, 1922.

Type.—In the Cornell University collection, Ithaca, New York.

Paratype.—In author's collection.

Hylemyia latipennis Zetterstedt

1838 *Anthomyia latipennis* Zett. Ins. Lapp., p. 676.

Localities.—1 ♀, McLean Bogs, near Ithaca, May 20, 1921 (collected by M. D. Leonard); 1 ♀, Ringwood (near Ithaca), June 13, 1922; 1 ♂, Mount McIntyre, August 29, 1922 (collected by R. C. Shannon and C. K. Sibley).

Hylemyia megacephala Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 188.

Localities.—1 ♂, Buttermilk, Ithaca, May 30, 1922; 1 ♂, 1 ♀, Montezuma Marshes, Cayuga, June 1, 1920.

Hylemyia piloseta Malloch

1918 *Hylemyia piloseta* Mall. Trans. Amer. Ent. Soc., vol. 44, p. 313.

1920 *Hylemyia nigribasis* Stein. Arch. Naturgesch., (1918) vol. 84, part 9, p. 78-79.

Female.—Head blackish, with whitish pruinescence. Thorax blackish, covered with a whitish gray pollen; three distinct, narrow, uniform, brownish vittae. Abdomen blackish, with whitish gray pollen. Wings and veins yellowish. Calyptrae and halteres yellowish.

Head, in profile, similar to that of *inornata* Stein. Third antennal segment narrow, its length equal to twice its breadth. Thorax with acrosticals weak and setulose; posthumeral bristle not duplicated. Pra long, equal in length to the following bristle. Sternopleurals, 1:2, all of equal size. Abdomen elongate, longer than thorax, with traces of a dorsocentral vitta. Fore tibia with two or three dorsal and one median posteroventral bristle; mid femur with two anteroventral and two or three posteroventral bristles; mid tibia with one anteroventral, three anterodorsal, three posterodorsal, and three posteroventral bristles; hind femur with a complete series of anteroventral bristles and an interrupted series of posteroventral bristles; hind tibia with three anteroventral, four anterodorsal, and three posterodorsal bristles; posterior surface with one or more appressed setulae. Costal thorn prominent. Upper calyptra covering the lower. Length, 7 mm.

Localities.—1 ♀, Ithaca, June 22, 1920; 1 ♂, Mount Marcy, July 13, 1918 (collected by W. T. M. Forbes).

Allotype.—In author's collection.

Hylemyia pluvialis Malloch

1918 *Hylemyia pluvialis* Mall. Canad. Ent., vol. 50, p. 310.

1920 *Hylemyia aniseta* Stein. Arch. Naturgesch., (1918) vol. 84, part 9, p. 77.

Female.—Yellowish gray, with dense, almost lemon yellow, pollen. Parafacials and cheeks, in profile, with whitish pruinescence and dark reflections. Parafrontals yellowish gray. Antennae and palpi black. Thorax and abdomen without vittae. Legs rufous, the femora entirely infuscated. Tarsi blackish. Wings slightly yellowish; veins yellow. Calyptrae whitish. Halteres yellowish white.

Head with cruciate bristles present. Antennae nearly reaching oral margin; arista pubescent. Thorax with only a few accessory setulae; acrosticals and prealar bristles absent; posthumeral bristles not duplicated. Sternopleurals, 1:2. Abdomen with the usual chaetotaxy, with no conspicuous bristles as in male. Fore tibia with one dorsal and one median posteroventral bristle. Mid femur with anteroventral surface bare, two or three basal posteroventral bristles; mid tibia with one weak anterior, two anterodorsal, two posterodorsal, and two weak posteroventral bristles. Hind femur with four or five anteroventral bristles along distal half; posterior surface bare, except for two apical bristles; hind tibia with three anteroventral, four anterodorsal, and three posterodorsal bristles; posterior surface without setulae. Costal thorn prominent, long; the costal hairs with a series of erect robust setulae; *m-cu* cross-vein straight and erect. Upper calyptra covering the lower. Length, 5.5 mm.

Localities.—1 ♂, 1 ♀, McLean Bogs (near Ithaca), July 2-3, 1904; 4 ♂, July 3, 1920; 1 ♂, August 6, 1921; 2 ♀, August 8, 1921. 9 specimens: 6 males, 3 females. Figures 19, 58, 116, 172, on plates in this memoir.

Allotype.—In the Cornell University collection, Ithaca, New York.

In the specimens before the writer, there is a variation in the infuscation of the legs. The femora vary in having all pairs completely infuscated, or only the first pair. The tibiae are rufous, with varying degrees of infuscation.

Hylemyia pullula Zetterstedt

1826 *Anthomyia longula* Meig. nec Fall. Syst. Besch., vol. 5, p. 103, no. 36.

1830 *Delia liturata* Rob.-Desv. Essai Myod., p. 575, no. 12.

1830 *Delia cinerascens* Rob.-Desv. Essai Myod., p. 575, no. 13.

1830 *Delia vernalis* Rob.-Desv. Essai Myod., p. 576, no. 14.

1845 *Aricia pullula* Zett. Dipt. Scand., vol. 4, p. 1449, no. 60.

Locality.—1 ♂, Ithaca, May 24, 1922 (collected by L. S. West).

Hylemyia sepia Meigen

1826 *Anthomyia sepia* Meig. Syst. Besch., vol. 5, p. 152.

1865 ?*Anthomyia haberlandti* Schin. Verh. Zool.-Bot. Ges. Wien., vol. 15, p. 999.

1911 *Adia flexicauda* Schnb. and Dzied. "Die Anthomyiden, p. 97.

Locality.—1 ♀, Hempstead, Long Island, April 10, 1921.

Hylemyia setigera Johannsen

1916 *Hammomyia setigera* Joh. Trans. Amer. Ent. Soc., vol. 42, p. 387.

Localities.—9 ♂, 2 ♀, Lakeville, Long Island, May 16, 1921; 12 ♂, 1 ♀, May 22, 1921; 2 ♂, 3 ♀, Glen Head, Long Island, May 19, 1921; 8 ♂, 2 ♀, June 4, 1921; 1 ♂, Danby (near Ithaca), June 4, 1916 (collected by E. G. Anderson); 1 ♂, Rock City, June 9, 1915; 1 ♂, 1 ♀, Ringwood (near Ithaca), June 26, 1920; 1 ♀, Buttermilk, Ithaca, July 10, 1920. 44 specimens: 34 males, 10 females. Figures 11, 62, 111, 173, on plates in this memoir.

Hylemyia setigera Johannsen most closely resembles *H. inornata* Stein. The males of *setigera* differ from those of *inornata* in the grayish pollen of the abdomen, in the broad, indefinite, subtriangular fasciae composing the dorsocentral vitta, and in the form of the genitalia.

Hylemyia setitarsata sp. nov.

Male.—Black, the thorax a dull drab color, the abdomen with dense whitish gray pruinescence. Head black; parafrontals, parafacials, and cheeks whitish gray pruinose, with dark reflections. Antennae and palpi black. Thorax, viewed from above and behind, with the presutural and humeral regions covered with a light grayish pollen; a distinct brownish median vitta, and traces of sublaterals; postsutural region and scutellum almost entirely blackish. Abdomen, viewed from above and behind, with a somewhat broad, black, dorsocentral vitta, each part of which broadens slightly anteriorly to fuse with the blackish tergal incisures. Legs black. Pulvilli white. Wings infuscated, veins brownish. Calyptreae white. Halteres yellow.

Eyes separated, at narrowest part, by a distance equal to that between posterior ocelli; parafrontals separated posteriorly by a thin frontal vitta. Head, in profile, with the facial margin almost vertical, a slight concavity about the middle; cheeks nearly as wide as length of third antennal segment, with a conspicuous tuft of a few upturned bristles near vibrissae. Antennae short; second segment with a few longish setae; third segment three-quarters as broad as long; arista bare, the proximal part noticeably thickened. Thorax with a series of paired acrosticals, one presutural pair well developed, the others weaker. Pra short, less than half length of the following bristle. Sternopleurals, 1:2. Abdomen short, depressed, parallel-sided, tapering slightly caudad, covered with stiff, erect bristles and setae; hypopygium very large and prominent; processes of fifth sternum with short setae, apices fringed with a row of stout spinules. Legs bristly. Fore tibia with a weak median and apical posteroventral bristle; apical region of dorsal surface with numerous longish bristles and setae. Mid femur with a few weak setulose bristles along proximal region of antero- and posteroventral surfaces; mid tibia with a conspicuous dorsal tuft of longish bristles and setae throughout distal half; posterior and posteroventral surfaces with one or two weak bristles; a strong ventral apical bristle. Hind femur with a complete row of anteroventral bristles and an interrupted row of weaker posteroventral bristles; hind tibia with a series of six or seven anteroventral setulae, four or five anterodorsal bristles, and four or five posterodorsal bristles, the last two series terminating a short distance before apex of tibia; at this interval a series of two or three dorsal bristles; posterior surface with a partial series of setulae; apical bristles very weak. Tarsi compressed except for segment 5, which is somewhat broadened; segments 2, 3, and 4 very short and small, beadlike; mid and hind tarsi with a dense tuft of erect bristles on dorsal and anterior surfaces of segments 1 to 4. Tarsal claws small; hind pulvilli conspicuous, twice as large as fore or mid pulvilli, which have become considerably reduced in size. Wings with costal

thorn minute, scarcely distinguishable from setulae; the fourth (distal) section of vein M_{1+2} two or three times as long as the third (previous) section; *m-cu* cross-vein erect; veins R_{4+5} and M_{1+2} slightly convergent at apices. Upper calyptra covering the lower. Length, 3.75 mm.

Female.—Similar to male except for the following characters: Color lighter than in male. Parafrontals brownish cinereous; parafacials and cheeks dull gray, with dark reflections. Thorax dull gray, with cinereous markings; viewed from above and behind, with traces of three brownish vittae on mesonotum and scutellum. Abdomen, viewed from above and behind, with dense grayish pollen; an ill-defined blackish dorsocentral vitta and incisures. Pulvilli infuscated.

Eyes widely separated; cruciates present. Cheeks smooth, bristles confined to ventral margin and caudal regions of head, with no conspicuous tuft of bristles near vibrissae. Abdomen conical. Fore tibia with one dorsal preapical bristle, one median posteroventral bristle, no median dorsal bristle. Mid femur with one or two basal anteroventral bristles; posteroventral surface bare except for the apical setae; mid tibia with one anteroventral, one antero-dorsal, two posterodorsal, and two posteroventral bristles. Hind femur with a complete series of anteroventral bristles; posteroventral surface bare except for the apical setae; hind tibia with two or three anteroventral, three or four anterodorsal, and two or three posterodorsal bristles; posterior surface bare of setulae. Tarsi normal, more depressed than in male. Tarsal claws and pulvilli small, of equal size throughout. Costal thorn distinct, larger than in male; the fourth (distal) section of vein M_{1+2} not twice as long as the third (previous) section. Length, 4 mm.

Localities.—21 ♂, 10 ♀, Hempstead, Long Island, April 10, 1921; 10 ♂, 7 ♀, April 24, 1921; 6 ♂, 1 ♀, Lake Ridge (near Ithaca), May 6, 1922; 4 ♂, McLean Bogs (near Ithaca), May 7, 1922; 1 ♂, Ithaca, May 12, 1922; 1 ♀, Coy's Glen, Ithaca, May 23, 1922. 61 specimens: 42 males, 19 females. Figures 8, 64, 101, 177, on plates in this memoir.

Type, allotype, and paratypes.—In the Cornell University collection, Ithaca, New York.

Paratypes.—In the United States National Museum collection, Washington, D. C.

The species *Hylemyia setitarsata* is one of the first of this genus to appear in the spring in perceptible numbers. The insects may be seen on the ground, flying about the dead leaves in the woods and coppices.

Hylemyia spizellae sp. nov.

Male.—Blackish species. Head blackish; parafrontals and parafacials with whitish pruinescence; parafacials and cheeks somewhat reddish. Antennae and palpi black. Thorax, viewed from above and behind, with a broad black median vitta and two narrow indefinite sublaterals. Abdomen grayish, with whitish pollen; with a broad black dorsocentral vitta, each section of which is dilated slightly toward the anterior margin of each tergum, where it merges with the dark transverse tergal incisure (as in *H. brassicae*). Legs black. Wings hyaline; veins brownish; cross-veins not clouded. Calyptrae tinged with brown. Halteres yellowish.

Head with eyes bare, separated at the narrowest by a distance equal to diameter of anterior ocellus; parafrontals contiguous posteriorly, each with four or five weak bristles; cruciate bristles present; parafacials, in profile, not prominent, but little receding ventrad; cheeks, in profile, diminishing to narrow proportions caudad, invaded by numerous bristles and setulae. Third antennal segment about twice as long as broad, not reaching oral margin; arista with minute pubescence, not noticeably swollen at base. Palpi slender; proboscis subshining. Thorax with a series of acrostical bristles which are irregularly paired, and with two pairs of presutural acrosticals which are stronger than the remaining bristles; posthumeral bristles duplicated; pra shorter than posterior notopleural bristle; sternopleural bristles, 2:2, the ventral bristle of the cephalic pair weaker than the others. Abdomen conical, depressed; second sternum with numerous longish bristles; third and fourth sterna with a series of long black bristles along their lateral margins (as in *H. florilega*); processes of fifth sternum cylindrical, widely separated at base, approximating distad; with a series of longish setulae along

entire inner border of each process; the outer surface of each process with numerous bristles. Fore tibia with two median setulae and a sharp apical posteroventral setula. Mid femur with a series of bristles along entire length of posteroventral surface, which are considerably longer and stronger proximad; the anteroventral surface with a few proximal setulae; mid tibia with one anterodorsal, one posterodorsal, and two or three posteroventral bristles, all of which are short. Hind femur with a series of bristles the entire length of the antero- and posteroventral surfaces, those of the posteroventral surface much weaker and shorter; hind tibia with one anteroventral, eight or nine anterodorsal, and three posterodorsal bristles; the posterior surface with a median series of setulae. Tarsi somewhat compressed; pulvilli elongate. Wings with small costal thorns; *m-cu* cross-vein erect, slightly sinuous. Lower calyptra covered by upper. Length, 4 mm.

Female.—Lighter in color than male, subshining. Frontal vitta reddish cephalad. Thorax nonvittate. Abdomen with indistinct dorsocentral fascia and transverse incisures. Legs blackish. Wings hyaline. Halteres yellow. Eyes separated by a distance nearly equal to length of second and third antennal segments. Cruciate bristles present. Antennae larger than in male, reaching oral margin; third antennal segment one and one-half times as long as broad; arista minutely pubescent. Palpi slender. Thorax with a series of weak cruciate bristles, irregularly paired; posthumeral bristles weakly duplicated; pra shorter than posterior notopleural bristle; sternopleural bristles, 2:2, the ventral bristle of each pair considerably weaker than the upper. Fifth abdominal tergum with semi-erect discal setae; abdominal sterna with no noticeable bristles as in male. Fore tibia with one anterodorsal and two posteroventral bristles. Mid femur with an entire series of posteroventral bristles; mid tibia with one anterodorsal, one posterodorsal, and two posteroventral bristles. Hind femur with the anteroventral bristles confined to the distal two-thirds, and with no series of posteroventral bristles; hind tibia with one anteroventral, five anterodorsal, and three posterodorsal bristles, the posterior surface without setulae. Tarsi missing in the specimen. Wings with *m-cu* cross-vein erect. Lower calyptra entirely covered by upper. Length, 4 mm.

Records.—2 ♂, C. U. exp. no. 1033, sub. 218; reared from chipping sparrow's nest; emerged March 17, 1924. 3 ♀, C. U. exp. no. 1033, sub. 243; reared from robin's nest; emerged March 13, 1924. (Collected by I. Dobrosky.)

Type, allotype, and paratype.—In the Cornell University collection, Ithaca, New York.

Hylemyia spizellae most closely resembles *H. florilega* and *H. linearis* Stein in the markings of the abdomen and the bristling of the abdominal sterna. The males of *spizellae* can be most readily distinguished from those of *florilega* in having the posthumeral bristles strongly duplicated, the hind femur armed with a series of posteroventral bristles, and the processes of the fifth sternum with a noticeable series of longish, weak bristles on their inner borders; and from the males of *linearis* in having the prealar bristle short, in lacking the tuft of bristles on the third abdominal sternum, and in the armature of the processes of the fifth sternum.

Hylemyia testacea Stein

1849 *Anthomyia aemene* Walk. List Dipt. Brit. Mus., part 4, p. 937, ♀. ?

1898 *Hylemyia testacea* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 208, no. 1.

Localities.—1 ♂, Kinderhook, June 1, 1915; 1 ♂, Ithaca, June 5, 1897; 1 ♂, 1 ♀, June 22, 1920; 1 ♀, Durlandville, June 29, 1917; 1 ♀, Oswego, July 16, 1921. 6 specimens: 3 males, 3 females. Figures 20, 65, 100, on plates in this memoir.

Hylemyia testacea Stein very closely resembles *H. depressa* Stein in structure and in chaetotaxy, but not in color. The male genitalia and the female ovipositor are exactly alike in the two species.

Hylemyia trichodactyla Rondani

- 1820 *Musca cinerella* Fall. p. p. Dipt. Suec. Musc., p. 77.
 1824 *Musca floralis* Fall. var. *g* and *d*. Musc., p. 71.
 1826 *Anthomyia platyura* Meig. p. p. Syst. Besch., vol. 5, p. 171.
 1838 *Anthomyia liturata* Meig. Syst. Besch., vol. 7, p. 329.
 1838 *Anthomyia striolata* Zett. p. p. Ins. Lapp., p. 684, no. 103.
 1845 *Aricia angustiventris* Zett. Dipt. Scand., vol. 4, p. 1542.
 1845 *Aricia florilega* Zett. p. p. Dipt. Scand., vol. 4, p. 1555.
 1866 *Chortophila trichodactyla* Rond. Atti Soc. Milano, vol. 9, p. 164.
 1884 *Anthomyia sancti-jacobi* Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 296, no. 2.

Records.—Earliest: Hempstead, Long Island, June 5, 1921. Latest: McLean Bogs (near Ithaca), September 11, 1920. 44 specimens, all males. Figures 3, 54, 106, on plates in this memoir.

The writer has a male and a female specimen of *Hylemyia trichodactyla*, which were reared from turnips at Ottawa, Ontario, on August 21 and 14, respectively. The specimens were kindly furnished for identification by Dr. McDunnough, of the Division of Entomology at Ottawa. The female of *trichodactyla* has always proved inseparable from that of *cilicrura*, and a close study of the reared specimen now available has aided but little in solving the problem. In the reared specimen of *trichodactyla*, the apices of the veins R_{4+5} and M_{1+2} converge somewhat more than is usual in *cilicrura*, and the hind tibia lacks the preapical setula on the posteroventral surface, which is very commonly found in *cilicrura*.

In comparing the reared specimen with a series of female specimens that had been collected at the same place and time as *trichodactyla* males, it was found that, of the twelve specimens examined, ten lacked the preapical setula on the hind tibia. Similarly, a series of twenty-two specimens of *cilicrura* was examined, which revealed that eighteen possessed the preapical setula, two proved uncertain cases, and two lacked the preapical setula.

Hylemyia trivittata Stein

- 1898 *Pegomyia trivittata* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 246, no. 10.

Records.—Earliest: Lakeville, Long Island, July 30, 1921. Latest: Hempstead, Long Island, September 11, 1921. 130 specimens: 58 males, 72 females. Figures 18, 70, 108, 174, on plates in this memoir.

Hylemyia unidorsalis sp. nov.

Male.—Black, with dense grayish pruinescence. Head blackish; parafrontals, parafacials, and cheeks whitish pruinose, with dark reddish brown reflections. Antennae and palpi black. Thorax blackish, the presutural and humeral regions, when viewed from above and behind, with light grayish pollen; a uniform blackish median vitta, and traces of sublateral vittae; postsutural area and scutellum blackish, with indistinct darker vittae. Abdomen, viewed from above and behind, with dense grayish white pruinescence; a uniform black dorsocentral vitta, and black anterior tergal incisures; hypopygium subshining. Legs black. Pulvilli whitish. Wings clear; veins brownish. Calyptres whitish. Halteres yellowish.

Eyes separated, at narrowest part, by a distance equal to diameter of anterior ocellus; parafrontals contiguous; dorsal series of postorbital setulae longish, equal in length to vertical and ocellar bristles. Parafacials and cheeks, in profile, narrow, in breadth less than width of

third antennal segment. Parafrontal bristles few. Second antennal segment short, in length less than breadth of third antennal segment, and with longish bristles; arista bare, noticeably thickened toward base. Palpi slender, the apices slightly flattened and expanded. Thorax with numerous accessory setulae; acrosticals irregularly paired, in two distinct rows, with three pairs of equally developed presutural acrosticals, the postsutural acrosticals weaker. Pra short, less than half length of the following bristle. Posthumeral bristles duplicated. Sternopleurals, 1:3. Abdomen depressed, narrow; hypopygium moderately thickened; processes of fifth sternum clothed with fine, short setae, the inner margins fringed with fine hairs, the apices surmounted with a stiff black bristle; inferior forceps (styles) long and slender. Each pair of legs of noticeably different lengths, the fore legs being the shortest and the hind legs the longest. Fore tibia with a longish dorsal preapical bristle. Mid femur with a complete row of anteroventral bristles; posteroventral bristles confined to proximal two-thirds of surface; mid tibia with one weak posteroventral and one weak posterodorsal bristle. Hind femur elongate, slender, basal half of anterodorsal surface bare and devoid of setulae; anterodorsal series of bristles confined to distal half of femur; anteroventral surface armed with a complete row of stout, uniform, closely set bristles directed ventrad; a similar series of weaker, shorter bristles on posteroventral surface; hind tibia setulose, with an antero- and a posteroventral series of setulose hairs; only one dorsal preapical bristle and one weaker posterodorsal bristle. Fore and hind tarsi compressed and attenuated distad; mid tarsi normal. Claws and pulvilli weak, minute. Wings narrow and somewhat pointed; costal thorn minute, scarcely distinguished from the costal setulae; *m-cu* cross-vein straight. Upper calyptra covering the lower. Length, 4.5 mm.

Locality.—1 ♂, Lake Ridge (near Ithaca), April 30, 1922.

Type.—In author's collection.

Hylemyia variata Fallén

1823 *Musca variata* Fall. Musc., p. 59.

1830 *Hylemyia rustica* Rob.-Desv. Essai Myod., p. 553.

1830 *Hylemyia liturata* Rob.-Desv. Essai Myod., p. 553.

1830 *Hylemyia florea* Rob.-Desv. Essai Myod., p. 553.

Records.—Earliest: Ithaca, April 30, 1915. Latest: Searingtown, Long Island, September 18, 1921. 31 specimens: 16 males, 15 females. Figures 17, 68, 114, on plates in this memoir.

Genus *Kingia* Malloch

1921 Mall. Bul. Brooklyn Ent. Soc., vol. 16, p. 53.

Kingia quintilis Malloch

1919 *Hylemyia quintilis* Mall. Canad. Ent., vol. 51, p. 275.

Locality.—1 ♀, New York (collected by J. Bequaert).

Genus *Macateeia* Malloch

1919 Mall. Proc. Biol. Soc. Wash., vol. 32, p. 1.

Macateeia protuberans Malloch

1919 Mall. Proc. Biol. Soc. Wash., vol. 32, p. 1.

Male.—Blackish; densely yellowish gray pruinose. Head with frontal vitta, parafrontals, parafacials, and cheeks, reddish, whitish gray pruinose; face and occiput grayish. Antennae black. Palpi testaceous yellow. Proboscis fuscous. Thorax blackish; when viewed from above and behind, the presutural and humeral regions with light grayish pollen; a broad median vitta, and traces of sublaterals and dark fascia behind the humeral callosities; postsutural region and scutellum blackish, with no traces of vittae. Abdomen, viewed from above and behind, with dense yellowish gray pollen; a uniform blackish dorsocentral vitta. Legs black.

Pulvilli infuscated. Wings slightly yellowish; veins yellowish brown. Calyptrae yellowish white. Halteres yellow.

Head, in profile, slightly longer from vertex to oral margin than from occipital region to base of antennae. Eyes separated, at narrowest part, by a distance slightly greater than that between posterior ocelli; parafrontals not contiguous. Parafacials, in profile, prominent, at base of antennae equal in width to length of third antennal segment; cheeks elongate, produced anteriorly; vibrissal area covered with numerous fine setae; oral margin somewhat produced anteriorly. Antennae short, separated by a narrow, distinct, facial prominence; third antennal segment one and one-half times as long as broad; arista minutely pubescent. Proboscis elongate, slender, nearly equal to length of thorax. Thorax with numerous fine accessory setulae; presutural acrosticals with two pairs of well-developed bristles besides a dense series of fine setulae which continue posteriorly along the mesonotum. Pra short, about one-half length of the following bristle; posthumeral bristles not duplicated. Sternopleural bristles, 1:2, with a third weaker bristle ventrad of the upper posterior pair. Abdomen depressed, gradually tapering to apex; hypopygium slightly thickened; processes of fifth sternum fringed on inner margins with fine hairs. Fore femur with a short median series of setulae on anterior surface; fore tibia with one dorsal and one median posteroventral bristle. Mid femur with two proximal anteroventral bristles and a proximal row of posteroventral bristles; mid tibia with one anterodorsal, two posterodorsal, and two or three posteroventral bristles. Hind femur with a complete series of strong anteroventral bristles and an interrupted series of posteroventral bristles; hind tibia with five anteroventral, four or five short, uniform, anterodorsal, and three or four posterodorsal bristles; posterior surface with two or three setulae on proximal half; a short, stout, curved, anteroventral apical bristle. Tarsal claws and pulvilli well developed. Costal thorn minute, indistinguishable from costal setulae; the apices of veins R_{4+5} and M_{1+2} converging noticeably; *m-cu* cross-vein straight. Upper calyptra covering the lower. Length, 6 mm.

Locality.—1 ♀, Hempstead, Long Island, September 16, 1921; 2 ♂, 1 ♀, September 11, 1921.

Allotype.—In author's collection.

The male of *Macateeia protuberans* Mall. differs most noticeably from that of *M. atra* Mall. in the breadth of the frons. One of the male specimens possesses a fine setula on the hypopleura immediately caudad of the posterior pair of sternopleural bristles.

All the specimens were collected on the flowers of goldenrod.

Genus *Neohylemyia* Malloch

1917 Mall. Bul. Brooklyn Ent. Soc., vol. 12, p. 37.

1919 Aldrich. Proc. Ent. Soc. Wash., vol. 21, p. 106. Pergandea.

1921 Aldrich. Ins. Menst., vol. 9, p. 98, Ganperdea.

Neohylemyia mallochii sp. nov.

Male.—Grayish black, with dense yellowish gray pollen. Head with frontal vitta, parafacials, parafrontals, and cheeks, reddish to black, whitish gray pruinose; occipital region and face grayish. First and second antennal segments reddish orange; third segment black; arista with distal part testaceous to blackish, the proximal part, namely the first and second segments, and the basal swelling of the third segment, blackish. Palpi yellowish testaceous, the distal half infuscated. Proboscis fuscous, somewhat slender. Thorax grayish, with yellowish pollen; when viewed from above and behind, the presutural and humeral regions with lighter grayish pollen than the postsutural area; a distinct dark median vitta on presutural region, which becomes suffused and indefinite caudad; sides of disk with dark lateral fascia; macrochaetae with dark basal spots on notum. Abdomen, viewed from above and behind, with dense yellowish gray pollen; a narrow, dark, dorsocentral vitta which is interrupted slightly at posterior border of each tergum. Legs yellowish; coxae and trochanters slightly

infuscated; femora largely infuscated; tibiae yellow. Tarsi black. Pulvilli infuscated. Wings slightly yellowish; veins yellowish brown. Calyptrae yellowish. Halteres yellow.

Eyes separated, at narrowest part, by a distance equal to twice that between posterior ocelli; parafrontals not contiguous. Parafrontals and parafacials, in profile, prominent, at base of antennae equal in width to breadth of third antennal segment. Frontal vitta with a pair of weak cruciate bristles. Anterior pair of ocellar bristles strongly developed. Cheeks broad, at narrowest part equal in breadth to length of third antennal segment. Vibrissal angles approximated, separated by a distance less than length of third antennal segment. Ventral half of occipital region of head considerably swollen. Antennae with second segment short, as broad along distal margin as its greatest length; third antennal segment rounded at apex, two or three times as long as broad; arista with the hairs long and few, sparsely distributed on opposite sides of segment, similar in appearance to the rays of *Musca domestica*; base of arista considerably swollen. Thorax with the acrosticals arranged irregularly in two closely adjacent rows, with usually two or three pairs of weak presutural bristles. Pra less than half length of the following bristle. Sternopleural bristles, 1:2, with a weaker third posterior bristle. Abdomen narrow, cylindrical, with stout, long, marginal bristles on dorsum; processes of fifth sternum clothed with short setulae and a few longish lateral bristles; apices slightly tapering and devoid of setae, with a few hairs present. Fore femur with a proximal series of short anteroventral bristles; fore tibia with one anterodorsal and one median posteroventral bristle. Mid femur with a proximal series of posteroventral bristles; mid tibia with one anterodorsal, one posterodorsal, and two posteroventral bristles. Hind femur with a complete series of anteroventral bristles; posteroventral surface bare except for one basal and three or four apical bristles; hind tibia with four or five anteroventral, four or five anterodorsal, and three posterodorsal bristles; posterior surface with an irregular series of setulae. Tarsal claws and pulvilli well developed. Costal thorn small. Upper calyptra covering the lower. Length, 6 mm.

Female.—Similar to male except for the following characters: Thorax with only a trace of a median vitta and lateral fasciae on disk. Abdomen non-vittate. Fore and mid femora infuscated along dorsal surface; hind femur yellow. Eyes separated by a broad frons; cruciate bristles weakly developed. Sternopleurals, 1:1. Abdomen conical. Mid femur with two basal setae on ventral surface, the antero- and posteroventral surfaces bare except for the usual apical setae. Hind femur with an interrupted row of anteroventral bristles, the posteroventral surface bare except for three or four apical setae; hind tibia with no series of setulae on posterior surface. Tarsal claws and pulvilli small. Wings broad and somewhat abrupt; costal thorn distinct; *m-cu* cross-vein straight. Length, 6 mm.

Localities.—1 ♀, Hempstead, Long Island, August 4, 1921; 7 ♂, 1 ♀, Glen Head, Long Island, August 10, 1921; 2 ♀, August 18, 1921; 11 ♂, Cold Spring Harbor, Long Island, September 10, 1921; 2 ♂, September 16, 1921; 2 ♂, September 4, 1922; 1 ♂, Renwick, Ithaca, August 11, 1921; 4 ♂, 1 ♀, Glen Head, Long Island, August 11, 1921. 32 specimens: 27 males, 5 females. Figures 50, 140, 155, 168, on plates in this memoir.

Type, allotype, and paratypes.—In the Cornell University collection, Ithaca, New York.

Paratypes.—In the United States National Museum collection, Washington, D. C.

There is a considerable variation in the infuscation of the femora in the series of male specimens of *Neohylemyia mallochii* before the writer. All but one of the specimens that were caught at Glen Head, Long Island, on August 10 and 11, 1921, have all the femora largely infuscated; in the one exception, the hind femora are yellow. In the series of specimens that were caught at Cold Spring Harbor, Long Island, on September 10, 1921, the fore femora are partly or wholly infuscated, and the mid and hind femora are yellow. Similarly, there appears to be a variation in the two series concerning the chaetotaxy of the legs. In the specimens from Glen Head, the anteroventral surface of the mid femora and the postero-

ventral surface of the hind femora are bare, except in one specimen in which there are two median bristles on the posteroventral surface. In all the specimens from Cold Spring Harbor, there are bristles on both these surfaces. In the specimens from Cold Spring Harbor, the third antennal segment is considerably narrower and longer, and the apices of the veins R_{4+5} and M_{1+2} converge more noticeably, than in the specimens from Glen Head.

This species is named in honor of Mr. J. R. Malloch, whose work has been of the greatest value to collectors and students of this group.

Genus *Paregle* Schnabl and Dziedzicki

1911 Schnb. and Dzied. Die Anthomyiden, p. 95.

1920 Stein. Arch. Naturgesch., (1918) vol. 84, part 9, p. 85. *Chortophila p. p.*

1921 Mall. Canad. Ent., vol. 53, p. 77. Egle.

Type, *Musca radicum* Linnaeus.

Generic characters.—Propleura bare; oral margin, when viewed in profile, noticeably produced beyond vibrissal angle; mid tibia with median anteroventral bristle; lower calyptra protruded beyond margin of upper.

The following key separates the species of *Paregle*:

Males and females

1. Hind tibia with two anterodorsal and two posterodorsal bristles; acrosticals uniformly paired, with few, if any, accessory setulae; calyptrae subequal. *cinerella* Fall.
- Hind tibia with three posterodorsal and five to eight anterodorsal bristles; acrosticals irregularly paired, with numerous accessory setulae between the rows; lower calyptra protruding well beyond margin of upper. *radicum* Linn.

Paregle cinerella Fallén

1825 *Musca cinerella* Fall. *p. p.* Musc., p. 77, no. 91.

1826 *Anthomyia pusilla* Meig. *p. p.* Syst. Besch., vol. 5, p. 151, no. 118.

1830 ? *Nerina albipennis* Rob.-Desv. Essai Myod., p. 557, no. 2.

1830 ? *Adia oralis* Rob.-Desv. Essai Myod., p. 558, no. 1.

1830 *Nerina flavescens* Rob.-Desv. Essai Myod., p. 558, no. 3.

1851 ? *Anthomyia rubrifrons* Macq. Dipt. Exot., Suppl., vol. 4, p. 237, no. 9.

1851 *Anthomyia virescens* Macq. Dipt. Exot., Suppl., vol. 4, p. 239.

1851 *Anthomyia trigonomaculata* Macq. Dipt. Exot., Suppl., vol. 4, p. 239.

1856 ? *Anthomyia similis* Fitch. 1st and 2d Repts., p. 301.

1860 *Aricia interruptilinea* Zett. Dipt. Scand., vol. 14, p. 6232, nos. 122-123.

1883 *Aricia remorata* Holmgr. Ent. Tidskr., vol. 4, p. 171, no. 29.

1900 *Egle trigonigaster* Pand. Rev. Ent. France, vol. 19, p. 242, no. 6.

Records.—Earliest: Franklin Square, Long Island, April 7, 1921. Latest: Searingtown, Long Island, September 18, 1921. 54 specimens: 28 males, 26 females. Figures 41, 84, 133, on plates in this memoir.

Paregle cinerella Fall. does not readily conform to the distinguishing characters enumerated above for this genus. It does, however, find its closest affinities with *Paregle*, with which it may be linked by the possession of a midventral bristle on the middle tibia, by the facial profile though this is not so pronounced as in *radicum*, and by the moderately large lower calyptra.

Paregle radicum Linnaeus

- 1761 *Musca radicum* Linn. Fauna Suec., p. 454, no. 1840.
 1780 *Musca napobrassicae* Bjerk. Acta Holm., p. 196.
 1817 *Anthomyia brassicae* Wied. Zool. Mag., vol. 1, p. 78, no. 27.
 1824 *Musca cinerea* Fall. p. p. Musc., p. 70, no. 75, ♀.
 1826 *Anthomyia pusilla* Meig. p. p. Syst. Besch., vol. 5, p. 151, no. 118.
 1826 *Anthomyia stigmatica* Meig. Syst. Besch., vol. 5, p. 167, no. 147.
 1826 *Anthomyia sprete* Meig. Syst. Besch., vol. 5, p. 171, no. 151.
 1826 *Anthomyia ruficeps* Meig. Syst. Besch., vol. 5, p. 177, no. 162.
 1830 *Egle vulgaris* Rob.-Desv. Essai Myod., p. 584, no. 1.
 1830 *Egle ludibunda* Rob.-Desv. Essai Myod., p. 585, no. 2.
 1830 *Egle campestris* Rob.-Desv. Essai Myod., p. 585, no. 3.
 1835 *Anthomyia obliqua* Macq. Hist. Nat. Dipt., vol. 2, p. 342, no. 37.
 1873 *Aricia tristicula* Holmgr. Öfv. K. Vet.-Akad. Förhandl., vol. 29, part 6, p. 101.
 1883 *Aricia diadema* Holmgr. Ent. Tidskr., vol. 4, p. 170, no. 27.

Records.—Earliest: Glen Head, Long Island, May 1, 1921. Latest: McLean Bogs (near Ithaca), September 11, 1920. 110 specimens: 71 males, 39 females. Figures 40, 85, 132, 192, on plates in this memoir.

Genus *Pegomyia* Robineau-Desvoidy

- 1830 Rob.-Desv. Essai Myod., p. 550, no. 1. *Hylemyia p. p.*
 1830 Rob.-Desv. Essai Myod., p. 557, no. 3. *Nerina p. p.*
 1830 Rob.-Desv. Essai Myod., p. 558, no. 4. *Adia p. p.*
 1830 Rob.-Desv. Essai Myod., p. 559, no. 5. *Phorbia p. p.*
 1830 Rob.-Desv. Essai Myod., p. 584, no. 14. *Egle p. p.*
 1830 Rob.-Desv. Essai Myod., p. 598, no. 1. *Pegomyia p. p.*
 1830 Rob.-Desv. Essai Myod., p. 600, no. 2. *Zabia p. p.*
 1830 Rob.-Desv. Essai Myod., p. 600, no. 3. *Phoraea.*
 1830 Rob.-Desv. Essai Myod., p. 602, no. 4. *Chlorina.*
 1835 Macq. Hist. Nat. Ins. Dipt., vol. 2, p. 323. *Chortophila p. p.*
 1838 Zett. Ins. Lapp., p. 660. *Anthomyza p. p.*
 1845 Zett. Dipt. Scand., vol. 4, p. 1371, no. 134. *Aricia p. p.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 989. *Gymnogaster.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 990. *Botanophila.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 990. *Triogonostoma.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 990. *Psilometopia.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 991. *Eriochia.*
 1864 Lioy. Atti Ist. Veneto, ser. 3, vol. 9, p. 991. *Stenogaster.*
 1906 Stein. Wien. Ent. Ztg., vol. 25, p. 47.
 1911 Schnb. and Dzied. Die Anthomyiden, p. 111.
 1920 Mall. Bul. Brooklyn Ent. Soc., vol. 15, p. 126. *Enneastigma* Stein.

The species of *Pegomyia* may be distinguished according to the following keys:

Males

1. Legs entirely blackish. 2
 Hind tibiae, at least, yellowish or reddish 4
2. Hind tibia with three anterodorsal bristles; pra exceeding half length of posterior notopleural bristle; hypopygium large and prominent. *rubivora* Coq.
 Hind tibia with two anterodorsal bristles; pra not exceeding half length of posterior notopleural bristle; hypopygium small and inconspicuous. 3
3. Thorax, when viewed from behind, with three broad black vittae, increasing in width cephalad; abdominal vitta interrupted by broad dark incisures along anterior half of each tergum *dissecta* Meig.
 Thorax without such vittae; abdominal vitta uniformly narrow, without incisures. *littoralis* Mall.

4. All femora infuscated 5
 All femora largely yellow, or the first pair only partly infuscated 8
5. Abdomen with a distinct mid-dorsal vitta; terga 4 and 5 with large brownish lateral areas on anterior half; palpi black *acutipennis* Mall. 8
 Abdomen with an ill-defined mid-dorsal vitta; no lateral markings on terga 6
6. Eyes separated by a distance equal to that between posterior ocelli; parafrontals not contiguous; calyptrae equal 7
 Eyes approximate; parafrontals contiguous posteriorly; lower calyptra protruded; palpi entirely infuscated *fringilla* Mall.
7. Pra longer than posterior notopleural bristle; third antennal segment entirely blackish; palpi entirely yellow; lateral margins of oral cavity and face without dark penciled markings *vanduzeei* Mall.
 Pra shorter than posterior notopleural bristle; third antennal segment with a narrow transverse orange band at base on inner side; palpi yellowish, with apices infuscated; lateral margins of oral cavity and face with dark penciled markings *ruficeps* Stein
8. Pra missing; *r-m* and *m-cu* cross-veins clouded; scutellum with a yellow streak on ventral surface; abdomen variegated in color *affinis* Stein
 Pra present; cross-veins clear; scutellum with no such marking 9
9. Abdomen largely yellow or yellowish; terga occasionally with narrow, dark, posterior incisures 10
 Abdomen blackish or grayish, without incisures 17
10. Thorax largely yellowish 11
 Thorax largely blackish 13
11. Thorax and antennae entirely yellowish testaceous; bristles near posterior margin of oral cavity gold-colored *unicolor* Stein
 Thorax, viewed from behind, with at least traces of a dorsocentral vitta; third antennal segment infuscated 12
12. Parafacials and cheeks, in profile, black, with whitish pruinescence; fifth abdominal sternum prominent, blackish; all femora entirely yellow *luteola* Mall.
 Parafacials and cheeks, in profile, yellowish; mid and hind femora with a small, infuscated, apical area on dorsal surface; fifth abdominal sternum inconspicuous, yellowish. *geniculata* Bouché
13. Palpi yellow 14
 Palpi infuscated 16
14. Lower calyptra distinctly larger than upper, protruding well beyond margin of upper; eyes separated, at narrowest part, by a distance about equal to diameter of anterior ocellus; abdominal terga with posterior incisures *fuscofasciata* Mall.
 Lower calyptra not larger than upper, protruding slightly, at most, beyond margin of upper; eyes separated, at narrowest part, by a distance at least equal to that between posterior ocelli; abdominal terga without incisures 15
15. Hind tibia with three posterodorsal bristles; scutellum entirely black; processes of fifth sternum blackened *bicolor* Wied.
 Hind tibia with two posterodorsal bristles; scutellum partly yellowish; processes of fifth sternum yellowish *calyptrata* Zett.
16. Tarsi black; lower calyptra protruding slightly beyond margin of upper; posthumeral bristles duplicated; hind tibia with four short, uniform, anterodorsal bristles. *nigritarsis* Zett.
 Tarsi yellowish, at least the metatarsi; lower calyptra protruding well beyond margin of upper; posthumeral bristles not duplicated; hind tibia with at most three anterodorsal bristles, not uniform in size *winthemi* Meig.
17. Palpi blackish; pra equal to or exceeding in length the posterior notopleural bristle; arista distinctly pubescent or plumose; parafrontals contiguous posteriorly 18
 Palpi yellow, with apices infuscated; pra short, half the length of posterior notopleural bristle; arista bare; parafrontals separated by a frontal vitta *hyoscyami* Panz.
18. Calyptrae and halteres whitish; basal segment of hypopygium polished, shining; posthumeral bristles not duplicated 19

- Calyptrae and halteres yellowish; basal segment of hypopygium pollinose; posthumeral bristles duplicated..... *lipsia* Walk.
19. Fore femora at base, on anterior (inner) surface, with a conspicuous, well-defined, brownish area; palpi spatulate; arista plumose..... *juvenilis* Stein
- Fore femora without such an area; palpi linear; arista with long pubescence..... *connexa* Stein

Females

1. Legs entirely blackish..... 2
- Hind tibiae, at least, yellowish or reddish..... 4
2. Hind tibia with three anterodorsal bristles; pra as long as posterior notopleural bristle..... 3
- rubivora* Coq.
- Hind tibia with two anterodorsal bristles; pra shorter than posterior notopleural bristle..... 3
3. Wings smoky; proboscis slender, highly polished; palpi linear, but slightly dilated apicad.....
- littoralis* Mall.
- Wings hyaline, transparent; proboscis short and stout, not highly polished; palpi short and spatulate.....
- dissecta* Meig.
4. All femora infuscated; antennae entirely black; palpi black.....
- fringilla* Mall.
- All femora largely yellow, or the first pair only partly infuscated..... 5
5. Pra missing; *r-m* and *m-cu* cross-veins clouded; scutellum with a yellow streak on ventral surface.....
- affinis* Stein
- Pra present; cross-veins clear; scutellum with no such marking..... 6
6. Abdomen largely yellow or yellowish; terga occasionally with narrow, dark, posterior incisures..... 7
- Abdomen largely blackish or grayish, occasionally with narrow, light-colored, posterior incisures on segments..... 15
7. Thorax largely yellowish..... 8
- Thorax largely blackish..... 10
8. Bristles around posterior margin of oral cavity gold-colored; setulae clothing humeral callosities and sternopleura also gold-colored; lower calyptra protruding well beyond margin of upper.....
- unicolor* Stein
- Bristles around posterior margin of oral cavity black; setulae clothing humeral callosities and sternopleura black..... 9
9. Mid and hind femora with a small, infuscated, apical area on dorsal surface; second segment of arista concolorous with base of third segment; lower calyptra protruding slightly but distinctly beyond margin of upper.....
- geniculata* Bouché
- Mid and hind femora with no such infuscation; second segment of arista noticeably infuscated, third segment yellow; lower calyptra not protruding beyond margin of upper.....
- luteola* Mall.
10. Mid and hind tarsi with segments 4 and 5 expanded into a club-shaped appendage..... 11
- Mid and hind tarsi with segments 4 and 5 normal, not expanded into a club-shaped appendage..... 12
11. Palpi yellow; cruciate bristles present.....
- fuscofasciata* Mall.
- Palpi infuscated; cruciate bristles absent.....
- winthemi* Meig.
12. Palpi infuscated; lower calyptra slightly but distinctly protruding beyond margin of upper.....
- nigritarsis* Zett.
- Palpi yellow; lower calyptra not visibly protruding beyond margin of upper..... 13
13. Hind tibia with three posterodorsal bristles.....
- bicolor* Wied.
- Hind tibia with two posterodorsal bristles..... 14
14. Scutellum blackish.....
- vanduzeei* Mall.
- Scutellum yellowish testaceous.....
- calyptrata* Zett.
15. Palpi entirely yellow, or yellow for the most part, excepting the apex..... 16
- Palpi blackish or largely infuscated..... 18
16. Pra shorter than posterior notopleural bristle..... 17
- Pra longer than posterior notopleural bristle; palpi entirely yellow; thorax with two distinct vittae along lines of dorsocentral bristles; arista noticeably swollen at base.....
- vanduzeei* Mall.

17. Third antennal segment with a narrow transverse orange band at base on inner side; lateral margins of oral cavity and face with dark penciled markings. *ruficeps* Stein
Third antennal segment wholly blackish; lateral margins of oral cavity and face without dark penciled markings. *hyoscyami* Panz.
18. Palpi broadened, spatulate; cruciate bristles present. 19
Palpi cylindrical, slightly expanded; cruciates absent. 20
19. Abdomen with a distinct dorsocentral vitta; terga 3, 4, and 5 with large brownish lateral areas on anterior half; fore femora without a distinctive brownish area at base of anterior (inner) surface; arista minutely pubescent. *acutipennis* Mall.
Abdomen without such markings, at most with dark fasciae; fore femora, at base, with a conspicuous, well-defined brownish area on anterior (inner) surface; arista plumose. *juvenilis* Stein
20. Fore tarsi with segments 2, 3, and 4 noticeably broadened; arista with dense short pubescence; third antennal segment half as wide as long. *lipsia* Walk.
Fore tarsi with segments 2, 3, and 4 normal, not noticeably broadened; arista with long pubescence; third antennal segment about one-third as wide as long. *connexa* Stein

Pegomyia acutipennis Malloch

1918 Mall. Trans. Amer. Ent. Soc., vol. 44, p. 301.

Locality.—1 ♂, Black Mountain, Lake George, September 4, 1920 (collected by M. D. Leonard).

Pegomyia affinis Stein

1898 *Pegomyia affinis* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 286.

1898 *Pegomyia vicina* Stein nec Lint. Berl. Ent. Ztschr., (1897) vol. 42, p. 239.

Records.—Earliest: Ithaca, May 27, 1920. Latest: Ithaca, August 1, 1920. 70 specimens: 42 males, 28 females. Figures 24, 73, 118, on plates in this memoir.

Pegomyia bicolor Wiedemann

1817 *Anthomyia bicolor* Wied. Zool. Mag., vol. 1, p. 77, no. 26.

1826 *Anthomyia mitis* Meig. Syst. Besch., vol. 5, p. 183, no. 173.

1826 *Anthomyia solennis* Meig. Syst. Besch., vol. 5, p. 187, no. 180.

1834 *Anthomyia rumicis* Bouché. Naturg. Ins., vol. 1, p. 209, no. 5.

1851 *Zabia longipes* Rob.-Desv. Guér.-Mén., Rev. et Mag. Zool., ser. 2, vol. 3, p. 233, no. 1.

Records.—Earliest: Long Island, April 10, 1921. Latest: Long Island, September 11, 1921. 89 specimens: 60 males, 29 females. Figures 33, 81, 121, 163, on plates in this memoir.

Pegomyia calyptrata Zetterstedt

1846 *Anthomyza calyptrata* Zett. Dipt. Scand., vol. 5, p. 1775, no. 159.

Records.—Earliest: Hempstead, Long Island, April 14, 1921. Latest: Black Mountain, Lake George, September 9, 1920 (collected by M. D. Leonard). 56 specimens: 20 males, 36 females. Figures 34, 77, 122, on plates in this memoir.

Forty-seven specimens bred from *Rumex crispus* on September 8–9, 1920.

Pegomyia connexa Stein

1920 *Pegomyia connexa* Stein. Arch. Naturgesch., May, (1918) vol. 84, part 9, p. 68.

1920 *Pegomyia emmesia* Mall. Trans. Amer. Ent. Soc., June, vol. 46, p. 179.

Records.—Earliest: Ithaca, April. Latest: Cold Spring Harbor, Long Island, September 10, 1921. 30 specimens: 14 males, 16 females. Figures 26, 71, 130, 191, on plates in this memoir.

Pegomyia dissecta Meigen

- 1826 *Anthomyia dissecta* Meig. Syst. Besch., vol. 5, p. 176, no. 160, ♂.
 1826 *Anthomyia infirma* Meig. Syst. Besch., vol. 5, p. 176, no. 161.
 1866 *Chortophila ignota* Rond. Atti Soc. Milano, vol. 9, p. 168, no. 20, ♂.
 1893 *Anthomyia humerella* Strobl nec Zett. p. p. Verh. Zool.-Bot. Ges. Wien, vol. 43, p. 256.

Localities.—12 ♂, 3 ♀, McLean Bogs (near Ithaca), May 7, 1922; 1 ♀, Ringwood (near Ithaca), July 13, 1920. 16 specimens: 12 males, 4 females. Figures 23, 119, 152, on plates in this memoir.

Pegomyia fringilla Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 181.

Localities.—1 ♀, Ithaca, May 2, 1915; 2 ♀, May 15, 1915; 1 ♀, May 28, 1922; 1 ♂, June 27, 1913. 5 specimens: 1 male, 4 females. Figure 158 on Plate XIII.

Pegomyia fuscofasciata Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 178.

Female.—Head and thorax blackish; abdomen reddish testaceous; frontal vitta, parafrontals, parafacials, face, and cheeks, black, with whitish pruinescence. Antennae with first and second segments, and base of third segment, yellowish; remainder of third segment infuscated. Palpi yellow. Proboscis fuscous, polished, shining. Thorax blackish, with dense whitish pollen, giving a bluish black color; no traces of vittae; scutellum with apex yellowish; humeral callosities blackish or yellowish testaceous. Abdomen non-vittate, with black posterior tergal incisures (traces only of such on fifth tergum). Legs yellow. Tarsi fuscous. Wings clear. Calyptrae whitish. Halteres yellowish.

Eyes separated by a frons equal in breadth to length of antennae; cruciate bristles present. Parafrontals and parafacials, in profile, very narrow. Third antennal segment nearly twice as long as broad. Arista with sparse, short pubescence, even to tip. Thorax with acrosticals well developed, in two regular rows, with numerous setulae between the rows. Pra about half as long as the following bristle. Sternopleurals, 1:2, with a weaker anteroventral bristle. Fore tibia with one dorsal and one median posteroventral bristle. Mid femur with two basal ventral bristles; mid tibia with one anterodorsal, one posterodorsal, and two posteroventral bristles. Hind femur with a row of diverse anteroventral bristles; posteroventral surface bare; hind tibia with one anteroventral, three uniform shortish anterodorsal, and two posterodorsal bristles; posterior surface bare. Mid and hind tarsi with third, fourth, and fifth segments broadened considerably. Costal thorn distinct. Lower calyptra protruding beyond margin of upper. Length, 5 mm.

Localities.—1 ♂, Ithaca, June 10, 1920; 6 ♂, Little Neck, Long Island, June 25, 1921; 1 ♀, Ringwood (near Ithaca), June 26, 1920; 1 ♀, Taughannock Falls (near Ithaca), June 26, 1920 (collected by M. D. Leonard); 1 ♂, Smithtown, Long Island, June 28, 1921; 2 ♂, Hempstead, Long Island, August 16, 1921; 1 ♀, Pearl Point, Lake George, August 31, 1920 (collected by M. D. Leonard); 1 ♀, Shelving Rock Bridge, Lake George, September 2, 1920 (collected by M. D. Leonard). 14 specimens: 10 males, 4 females. Figures 29, 83, 126, 186, on plates in this memoir.²

Allotype.—In the Cornell University collection, Ithaca, New York.

Pegomyia geniculata Bouché

- 1834 *Anthomyia geniculata* Bouché. Naturgesch. Ins., vol. 1, p. 81, no. 69.
 1840 *Anthomyia univittata* v. Ros. Correspondenzbl. Württemb. Ver., vol. 1, p. 59. ?
 1846 *Anthomyza ephippium* Zett. Dipt. Scand., vol. 5, p. 1790, no. 174.
 1866 *Anthomyia euphyppium* Rond. Atti Soc. Milano, vol. 9, p. 155, no. 17.

² The descriptions and figures of the ovipositor in a recent paper by the writer (Huckett, 1921) represent (a) *fuscofasciata* and not *winthemi* (figure 24), and (b) *geniculata* and not *unicolor* (figure 26).

Localities.—2 ♂, 2 ♀, Ithaca, May 20, 19— (bred by O. A. Johannsen); 1 ♂, Ithaca, June 22, 1917 (collected by S. H. Emerson); 1 ♀, July 2, 1916; 1 ♂, July 9, 1891; 2 ♂, 1 ♀, Herkimer, August 8, 1921 (collected by M. D. Leonard); 1 ♀, Cold Spring Harbor, Long Island, September 10, 1921; 3 ♀, McLean Bogs (near Ithaca), September 11, 1920; 1 ♂, no record. 15 specimens: 7 males, 8 females. Figures 25, 76, 128, on plates in this memoir.

Pegomyia hyoscyami Panzer

- 1809 *Musca hyoscyami* Panz. Fauna Germ., p. 108, no. 13.
 1825 *Musca conformis* Fall. Musc., p. 82, no. 105, ♀.
 1826 *Anthomyia egens* Meig. Syst. Besch., vol. 5, p. 181, no. 169, ♀.
 1826 *Anthomyia exilis* Meig. Syst. Besch., vol. 5, p. 184, no. 175, ♀.
 1847 *Anthomyia hyoscyami* var. *betae* Curt. Journ. Agr. Soc. Eng., vol. 8, part 2, p. 412.
 1849 *Anthomyza dissimilipes* Zett. Dipt. Scand., vol. 8, p. 3311, nos. 62–63.
 1851 *Pegomyia gouraldi* Rob.-Desv. Guér.-Mén., Rev. et Mag. Zool., ser. 2, vol. 3, p. 231, no. 2. ?
 1851 *Pegomyia atriplicis* Gour. Ann. Soc. Ent. France, vol. 2, p. 9, no. 163.
 1866 *Chortophila chenopodii* Rond. Atti Soc. Milano, vol. 9, p. 162, no. 4.
 1866 *Chortophila cunicularis* Rond. Atti Soc. Milano, vol. 9, p. 163, no. 5, ♀.
 1866 *Chortophila perforans* Rond. Atti Soc. Milano, vol. 9, p. 163, no. 6.
 1866 *Chortophila effodiens* Rond. Atti Soc. Milano, vol. 9, p. 163, no. 8.
 1879 *Anthomyia conformis* Farsky. Verh. Zool.-Bot. Ges. Wien, vol. 29, p. 107.
 1880 *Anthomyia femoralis* Brischke. Schrift. Ges. Danzig, vol. 5, p. 275.
 1880 *Anthomyza spinaciae* Holmgr. Ent. Tidskr., vol. 1, p. 89.
 1882 *Pegomyia vicina* Lint. nec Stein. New York Rept., p. 208.
 1901 *Pegomyia haemorrhoea* Pand. nec Zett. Rev. Ent. France, vol. 20, p. 298, no. 11.

Records.—Earliest: Elmont, Long Island, May 2, 1921. Latest: Long Island, August 27, 1921. 33 specimens: 21 males, 12 females. Figures 32, 79, 123, on plates in this memoir.

At Ithaca specimens were reared from the leaves of mangolds, beets, and lamb's-quarters (*Chenopodium album*) during August, 1920.

Pegomyia juvenilis Stein

- 1898 *Hylemyia juvenilis* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 211, no. 3.

Records.—Earliest: Lakeville, Long Island, May 16, 1921. Latest: Shelving Rock Bridge, Lake George, September 2, 1920 (collected by M. D. Leonard). 22 specimens: 14 males, 8 females. Figures 27, 74, 131, on plates in this memoir.

Pegomyia lipsia Walker

- 1849 *Anthomyia lipsia* Walk. List Dipt. Brit. Mus., part 4, p. 928.
 1849 *Anthomyia substituta* Walk. List Dipt. Brit. Mus., part 4, p. 971.
 1867 *Anthomyia tarsata* V. d. Wulp. Tijd. Ent., vol. 10, p. 151, no. 22.

Records.—Earliest: Aurora, May 16, 1920. Latest: McLean Bogs (near Ithaca), September 3, 1920. 200 specimens. Figures 22, 72, 120, on plates in this memoir.

Pegomyia littoralis Malloch

- 1920 Mall. Bul. Brooklyn Ent. Soc., vol. 15, p. 127.

Female.—Blackish. Head with an opaque, black, frontal vitta; parafrontals, parafacials, and cheeks, in profile, whitish pruinose, with darker reflections. Occipital region grayish. Antennae and palpi blackish. Proboscis fuscous, polished and shining. Thorax with brownish cinereous pollen, non-vittate, subshining; viewed from above and behind, the humeral

and notopleural callosities with light grayish pollen. Abdomen shining, with traces of grayish pollen; non-vittate. Legs blackish. Wings infuscated; veins brownish. Calyptrae infuscated. Halteres yellowish.

Eyes separated by a distance slightly greater than length of antennae; cruciate bristles present. Third antennal segment twice as long as second; arista with short, distinct pubescence. Thorax with the acrosticals well developed, paired, in two regular rows. Pra less than half length of the following bristle. Sternopleurals, 1:2. Fore tibia with one dorsal and one median posteroventral bristle. Mid femur with two or three basal bristles on ventral surface; mid tibia with one anterodorsal, one posterodorsal, and two posterior bristles. Hind femur with a series of diverse anteroventral bristles and two proximal ventral bristles; hind tibia with one or two anteroventral, two anterodorsal, and two posterodorsal bristles. Wings with the costal thorn distinct; *m-cu* cross-vein erect. Upper calyptra covering the lower. Length, 5 mm.

Locality.—8♀, Old Forge, August 6, 1905. 8 specimens, all females. Figure 188 on Plate XVIII.

Allotype.—In the Cornell University collection, Ithaca, New York.

Pegomyia luteola Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 175.

Female.—Yellowish testaceous. Head reddish; parafrontals, parafacials, and cheeks, silvery pruinose. Frontal vitta reddish anteriorly, blackish posteriorly. Occipital region grayish; bristles around oral margin black. Antennae with first and second segments and base of third segment yellowish; remainder of third segment infuscated; arista yellowish, except for the second segment, which is distinctly infuscated and shining. Palpi yellow. Proboscis yellowish. Thorax with notum reddish testaceous, with yellowish gray pollen; viewed from above and behind, with traces of a blackish median vitta. Abdomen non-vittate, with blackish posterior tergal incisures. Legs yellow. Tarsi yellow, with dense black setulae. Wings clear. Calyptrae clear. Halteres yellowish white.

Eyes separated by a distance nearly equal to length of antennae; cruciate bristles absent or present. Third antennal segment twice as long as broad. Thorax with acrosticals paired, well developed. Pra less than half length of the following bristle. Sternopleurals, 1:2. Fore tibia with one dorsal and one posteroventral bristle. Mid femur with two proximal ventral bristles; mid tibia with one anterodorsal, one posterodorsal, and two posteroventral bristles. Hind femur with a series of diverse anteroventral bristles; hind tibia with one anteroventral, two anterodorsal, and two posterodorsal bristles. Costal thorn small but distinct; *m-cu* cross-vein slightly sinuous. Calyptrae subequal. Length, 5.5 mm.

Localities.—1♀, Ithaca, June (collected by R. C. Shannon); 4♂, Lakeville, Long Island, July 9, 1921; 1♀, Cold Spring Harbor, Long Island, August 27, 1921; 1♀, Pearl Point, Lake George, August 31, 1920 (collected by M. D. Leonard). 7 specimens: 4 males, 3 females. Figures 21, 75, 129, 189, on plates in this memoir.

Allotype.—In the Cornell University collection, Ithaca, New York.

Pegomyia nigratarsis Zetterstedt

1826 *Anthomyia fulgens* Meig. Syst. Besch., vol. 5, p. 183, no. 172.

1826 *Anthomyia versicolor* Meig. Syst. Besch., vol. 5, p. 184, no. 174.

1840 *Anthomyia rufitrons* v. Ros. p. p. Correspondenzbl. Württemb. Ver., vol. 1, p. 59, ♀.

1840 *Anthomyia nigratarsis* Zett. Ins. Lapp., p. 696, no. 159.

1851 ?*Pegomyia acetosae* Rob.-Desv. Guér.-Mén., Rev. et Mag. Zool., ser. 2, vol. 3, p. 232, no. 4.

1862 *Anthomyia exilis* Schin. nec Meig. Fauna Austr., part 1, p. 636.

Localities.—1♂, Montezuma Marshes, Cayuga, June 1, 1920; 1♂, Valley Stream, Long Island, April 27, 1921.

Pegomyia rubivora Coquillett

1897 *Phorbia rubivora* Coq. Canad. Ent., vol. 29, p. 162.

Localities.—1 ♂, 1 ♀, C. U. exp. no. 576, April 8, 1897; 1 ♂, April 10, 1897; 1 ♀, Ithaca, May 1, 1913; 1 ♀, Ringwood (near Ithaca), May 3, 1922. 5 specimens: 2 males, 3 females. Figures 28, 82, 127, on plates in this memoir.

(These specimens, from the Cornell University collection, reared from raspberry canes by Professor M. V. Slingerland.)

Pegomyia ruficeps Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 286, no. 13.

Localities.—1 ♀, Riverhead, Long Island, July 15, 1923; 1 ♂, Ithaca, August 3, 1920; 1 ♀, August 5, 1920; 1 ♂, Burlington, Ontario, Canada, no date given. 4 specimens: 2 males, 2 females. Figure 159 on Plate XIII.

(Specimens from Burlington and Ithaca reared from the leaves of pigweed, *Amaranthus retroflexus*.)

Pegomyia unicolor Stein

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 236, no. 1.

Localities.—1 ♀, McLean, June 20, 1904; 1 ♀, Little Neck, Long Island, July 2, 1921; 1 ♀, McLean Bogs (near Ithaca), July 3, 1920; 1 ♂, Richmond, Staten Island, July 21, 1920; 1 ♂, July 26, 1920; 1 ♀, Lakeville, Long Island, August 20, 1921. 6 specimens: 2 males, 4 females. Figure 190 on Plate XVIII.

Pegomyia vanduzeei Malloch

1919 Mall. Proc. Calif. Acad. Sci., vol. 9, p. 307, ♂.

1919 Frost. Journ. Agr. Res., vol. 16, p. 240. *P. affinis* Stein.

Female.—Head reddish, thorax blackish, abdomen yellowish testaceous; parafrontals, parafacials, and cheeks reddish, whitish pruinose. Frontal vitta reddish. Vertex, ocellar triangle, and occipital region, grayish. First and second antennal segments yellowish, third segment and arista blackish. Palpi yellow. Proboscis fuscous, shining. Thorax entirely blackish, with whitish pollen, giving a bluish black appearance; dark sublateral vittae, and faint traces of a median vitta. Abdomen reddish testaceous, basal half mottled with bluish black markings to a greater or less extent. Legs yellow; coxae and fore femora partly infuscated. Tarsi black. Wings clear; veins yellowish. Calyptrae whitish. Halteres yellowish white.

Eyes separated by a distance slightly greater than length of antennae. Parafacials and cheeks broad and conspicuous. Frontal vitta broad and prominent, margins subparallel, cruciate bristles absent. Antennae short; third segment one and one-half times as long as broad; arista minutely pubescent, noticeably swollen at base. Thorax with numerous accessory setulae; acrosticals distinct, in two irregular rows, the presutural acrosticals more strongly developed than the postsutural bristles. Pra equal to at least half length of the following bristle; posthumeral bristles duplicated. Sternopleurals, 1:2, with a weaker ventral anterior bristle. Abdomen short, broadly ovoid, slightly shorter than length of thorax. Fore tibia with one dorsal and one posteroventral bristle. Mid femur with two proximal ventral bristles; mid tibia with one anterodorsal, one posterodorsal, and two posteroventral bristles. Hind femur with a row of anteroventral bristles and two or three proximal ventral bristles; hind tibia with two anteroventral, two anterodorsal, and two posterodorsal bristles. Costal thorn small. Calyptrae subequal. Length, 5 mm.

Localities.—1 ♀, Ithaca, April, 30, 1915; 1 ♀, May 8, 1914; 1 ♂, 1 ♀, May 5, 1915; 1 ♂, May 8, 1915; 2 ♂, May 15, 1915; 1 ♂, May; 1 ♂, Taughannock Falls (near Ithaca), May 15, 1915. 9 specimens: 6 males, 3 females. Figures 36, 78, 124, 164, on plates in this memoir.

Allotype.—In the Cornell University collection, Ithaca, New York.

Pegomyia winthemi Meigen

- 1826 *Anthomyia winthemi* Meig. Syst. Besch., vol. 5, p. 186, no. 179, ♀.
 1839 ?*Sapromyza blepharipteroides* Duf. Ann. Soc. Nat., ser. 2, vol. 12, p. 42, no. 12.
 1840 *Anthomyia scutellaris* v. Ros. Correspondenzbl. Württemb. Verh., vol. 1, p. 9, ♀.
 1846 *Anthomyza capucina* Zett. Dipt. Scand., vol. 5, p. 1753, no. 135.
 1846 *Anthomyza latitarsis* Zett. Dipt. Scand., vol. 5, p. 1754, no. 136.
 1866 *Anthomyia digitaria* Rond. Atti Soc. Milano, vol. 9, p. 152, no. 13.
 1883-84 *Pegomyia transversa* Meade nec Fall. Ent. Mo. Mag., vol. 20, p. 12.
 1906 *Pegomyia winthemi* var. *obscura* Stein. Wien. Ent. Ztg., vol. 25, p. 62.

Records.—Earliest: Lakeville, Long Island, May 22, 1921. Latest: McLean Bogs (near Ithaca), September 9, 1920. 35 specimens: 21 males, 14 females. Figures 30, 80, 125, 187, on plates in this memoir.

Genus *Pogonomyza* Schnabl and Dziedzicki

- 1911 Schnb. and Dzied. Die Anthomyiden, p. 99.
 1916 Stein. Arch. Naturgesch., (1915) vol. 10, p. 138. *Hylemyia p. p.*
 1921 Mall. Canad. Ent., vol. 53, p. 78.

The following keys separate the species of *Pogonomyza*:

Males

1. Hind tibia with antero- and posteroventral apical bristles; blackish species, shining. . . . 2
 Hind tibia with only an anteroventral apical bristle present, the position for the posteroventral apical bristle being filled by a series of setulae; grayish species, densely pollinose. . . . *cinerosa* Zett.
2. Arista plumose, the longest hairs exceeding in length the breadth of the third antennal segment. *flavipennis* Fall.
 Arista pubescent or bare, the longest hairs shorter than the breadth of the third antennal segment. 3
3. Mid femur with a number of strong bristles on apical half of anteroventral surface, and two very long bristles on basal half of posteroventral surface. . . . *spinosissima* Mall.
 Mid femur without any strong bristles on apical half of anteroventral surface; the bristles on basal half of posteroventral surface short. 4
4. Wings infuscated, smoky; arista with a noticeable subglobose swelling at base; antennae and arista black. *gleniensis* sp. nov.
 Wings yellowish; arista not noticeably swollen at base; second antennal segment yellowish along apical border. *proboscidalis* Mall

Females

1. Hind tibia with antero- and posteroventral apical bristles; black species, shining; wings yellowish. 2
 Hind tibia with only an anteroventral apical bristle, the position for the posteroventral apical bristle being filled by a series of setulae; grayish species, densely pollinose. . . . *cinerosa* Zett.
2. Arista plumose, the longest hairs exceeding in length the breadth of the third antennal segment. *flavipennis* Fall.
 Arista pubescent or bare, the longest hairs shorter than the breadth of the third antennal segment. 3
2. Pra longer than posterior notopleural bristle; abdomen piceous, polished and shining. . . . *campestris* sp. nov.
 Pra shorter than posterior notopleural bristle; abdomen blackish, with traces of brownish gray pollen. 4

4. Mid femur with one or more prominent bristles on distal half of anteroventral surface; fore tibia with three dorsal and three posterior bristles; mid femur with an uninterrupted row of bristles on anterior surface. *spinosissima* Mall.
 Mid femur with only setulae on distal half of anteroventral surface; fore tibia with one or two bristles on dorsal and posterior surfaces; mid femur with an interrupted row of bristles on anterior surface. *proboscidalis* Mall.

Pogonomyza campestris sp. nov.

Female.—Black species, shining. Head black; parafrontals, parafacials, and cheeks, silvery gray pruinose, with blackish reflections. Frontal vitta black, opaque. Antennae, palpi, and proboscis, black. Thorax blackish, with brownish gray pollen, subshining. Abdomen piceous, polished, shining, with no trace of pollen. Legs black, subshining. Pulvilli fuscous. Wings yellowish; veins yellow. Calyptrae whitish, tinged. Halteres yellow.

Eyes separated by a distance slightly less than one-third width of head. Frontal vitta nearly equal in breadth to length of third antennal segment; sides subparallel; cruciate bristles well developed; parafrontals with a few accessory setulae on posterior half. Parafacials and cheeks narrow. Antennae short, equal in length to distance between vibrissae; vibrissae strong and long; arista with short pubescence. Thorax with irregularly paired acrostical bristles, between which are numerous setulae. Pra two-thirds as long as the following bristle; posthumeral bristle not duplicated. Sternopleural bristles, 1:2, with an additional weaker anterior bristle below. Abdomen broadly subovoid; tergum 4 with strong, erect, marginal bristles; terga 2, 3, and 5 with weaker, appressed, marginal bristles; terga 4 and 5 with a transverse series of strong, erect, discal bristles on dorsum; tergum 3 with only lateral discal bristles present on dorsum. Fore tibia with one weak anterodorsal, one median dorsal, and one posterior bristle. Mid femur with a continuous row of bristles on anterior surface, the anteroventral surface bare, and the posteroventral surface with three bristles along proximal half; mid tibia with one anterodorsal, one posterodorsal, and three posterior bristles. Hind femur with a row of bristles for almost the entire length of anteroventral surface; posteroventral surface with four bristles along proximal half, besides the usual apical bristles; hind tibia with five anteroventral, five anterodorsal, and three or four posterodorsal bristles, and a postero- and an anteroventral apical bristle. Costal thorn prominent; *m-cu* cross-vein erect. Upper calyptra covering the lower. Length, 5.5 mm.

Locality.—1 ♀, Montezuma Marshes, Cayuga, New York, June 1, 1920.

Type.—In author's collection.

Pogonomyza campestris differs from *P. proboscidalis*, the species which it most closely resembles, in the length of the prealar bristle, the normal thickness of the mid femora, and the polished appearance of the abdomen.

Pogonomyza cinerosa Zetterstedt

1826 *Anthomyia cinerella* Meig. nec Fall. Syst. Besch., vol. 5, p. 100, no. 30.

1845 *Aricia cinerosa* Zett. Dipt. Scand., vol. 4, p. 1450, no. 61.

1864 *Aricia xanthoptera* Bohem. Öfv. K. Vet.-Akad. Förhandl., vol. 20, p. 83, no. 27.

Locality.—1 ♀, Ringwood (near Ithaca), June 14, 1920.

Pogonomyza flavipennis Fallén

1823 *Musca flavipennis* Fall. Musc., p. 59, no. 52.

1826 *Anthomyia crassirostris* Meig. Syst. Besch., vol. 5, p. 107, no. 42.

Localities.—1 ♂, Malloryville, June 18–20, 1904; 1 ♀, Freeville, July 4, 1904.

Pogonomyza gleniensis sp. nov.

Male.—Blackish, fuscous, shining. Head black; frontal vitta, parafrontals, parafacials, and cheeks, blackish, with whitish pruinescence. Antennae, arista, palpi, and proboscis

blackish, the proboscis shining. Thorax blackish, shining, with brownish gray pollen; non-vittate. Abdomen with traces of grayish pollen, shining; viewed from above and behind, with broad, fuscous, subtriangular, tergal fascia in mid-dorsal line. Legs black. Pulvilli infuscated. Wings infuscated; veins brownish. Calyptrae whitish, tinged. Halteres yellow.

Eyes separated, at narrowest part, by a distance nearly equal to that between posterior ocelli; parafrontals separated by a linear frontal vitta. Parafrontals and parafacials, in profile, narrow. Parafrontal bristles few and widely spaced; vibrissae long and strong. Third antennal segment three-quarters as broad as long; arista minutely pubescent, conspicuously swollen at base. Proboscis very stout and fleshy. Thorax with the acrosticals distinct, irregularly paired in two series; one pair of presutural bristles more strongly developed than the other two pairs. Pra short, less than half length of the following bristle; post-humerals with weak duplicating bristles. Sternopleural bristles, 1:2, in addition to weak anterior and posterior bristles below. Abdomen depressed, parallel-sided, twice as long as broad; terga 3, 4, and 5 with transverse rows of marginal and discal bristles; hypopygium inconspicuous; in profile, the abdomen but little thickened. Fore femur with a proximal series of weak bristles on anteroventral surface; fore tibia with one anterodorsal and one median posteroventral bristle. Mid femur with an appressed series of weak bristles on distal half of anteroventral surface, and two proximal posteroventral bristles; mid tibia with one anterior, one posterodorsal, and one posterior bristle. Hind femur with a complete row of anteroventral bristles, the posteroventral surface bare except for the normal apical bristles; hind tibia with three or four anteroventral, three or four anterodorsal, and three or four posterodorsal bristles; posterior surface with a median series of setulae; an antero- and a posteroventral apical bristle. Wings broad; costal thorn distinct, longish; *m-cu* cross-vein erect. Upper calyptra covering the lower. Length, 4 mm.

Locality.—1 ♂, Coy's Glen, Ithaca, May 14, 1922.

Type.—In author's collection.

Pogonomyza gleniensis differs from *P. spinosissima* in the chaetotaxy of the legs, and from *P. proboscidalis* in the coloration of the wings and calyptrae. In appearance and form, the abdomen is very similar to that of *Hylemyia laevis* Stein. This species differs, however, in possessing discal bristles on terga 3, 4, and 5, as well as the usual marginal bristles.

Pogonomyza proboscidalis Malloch

1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 185.

Localities.—1 ♀, Plandome, Long Island, May 21, 1921; 3 ♂, 1 ♀, Hempstead, Long Island, June 19, 1921.

Pogonomyza spinosissima Malloch

1919 *Hylemyia* (*Pogonomyza*) *spinosissima* Mall. Canad. Ent., vol. 51, p. 95.

Locality.—1 ♀, Ringwood (near Ithaca), July 13, 1920.

Genus *Proboscimyia* Bigot

1883 Bigot. Bul. Soc. Ent. France, no. 4, p. 30.

1884 Bigot. Ann. Soc. Ent. France, ser. 6, vol. 4, p. 266. *Proboscidomyia*.

1898 Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 230. *Dolichoglossa*.

Proboscimyia siphonina Bigot

1883 *Proboscimyia siphonina* Bigot. Bul. Soc. Ent. France, no. 4, p. 30.

1898 *Dolichoglossa americana* Stein. Berl. Ent. Ztschr., (1897) vol. 42, p. 230, no. 1.

Locality.—1 ♀, Westfield, September 3, 1904.

Genus *Prosalpia* Pokorný

- 1893 Pokorný. Wien. Ent. Ztg., vol. 12, p. 54.
 1916 Stein. Arch. Naturgesch., (1915) vol. 10, p. 156.
 1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 183.

The following key separates the female specimens of *Prosalpia*:

Females

1. Fore tarsus with segments 2 and 3 noticeably broadened; thorax with at least one pair of strongly developed presutural acrostical bristles, stouter and longer than the parafrontal bristles. *silvestris* Fall.
- Fore tarsus with segments 2 and 3 normal, not noticeably broadened; thorax with presutural acrostical bristles weakly developed, not so stout nor so long as the parafrontal bristles. *angustitarsis* Mall.

Prosalpia angustitarsis Malloch

- 1920 Mall. Trans. Amer. Ent. Soc., vol. 46, p. 184.

Localities.—1 ♂, Beaver Kill, August 12, 1909 (collected by E. T. Cresson); 1 ♀, Black Mountain, Lake George, September 4, 1920 (collected by M. D. Leonard).

Prosalpia silvestris Fallén

- 1824 *Musca silvestris* Fall. Musc., p. 70, no. 74.
 1838 *Anthomyza argyrocephala* Zett. Ins. Lapp., p. 670, no. 37, ♀.
 1838 *Anthomyza murina* Zett. Ins. Lapp., p. 682, no. 91, ♀.
 1845 *Aricia argyrata* Zett. Dipt. Scand., vol. 4, p. 1443, no. 53, ♀.
 1845 *Aricia decrepita* Zett. Dipt. Scand., vol. 4, p. 1454, no. 65, ♀.
 1849 *Anthomyia alpina* Walk. List Dipt. Brit. Mus., part 4, p. 927, ♀.
 1849 *Anthomyia donuca* Walk. List Dipt. Brit. Mus., part 4, p. 946, ♀.
 1849 *Eriphia grisea* Walk. List Dipt. Brit. Mus., part 4, p. 962, ♂.
 1860 *Aricia lepturoides* var. *b* Zett. Dipt. Scand., vol. 14, p. 6235, no. 125, ♂.
 1862 *Eriphia billbergi* Schin. nec Zett. Fauna Austr., part 1, p. 626, ♀.
 1893 *Prosalpia hydrophorina* Pokorný. Wien. Ent. Ztg., vol. 12, p. 59, no. 3.

Locality.—1 ♀, Lake Tackawasick, June 25, 1920 (collected by M. D. Leonard).

THE MORPHOLOGY OF THE GENITALIA

In order to prevent a possible misdetermination of the species of the subfamily Anthomyiinae, especially of its more closely related forms, and to make clear those distinctions by which the species or specimens discussed in this paper can be recognized, it seems advisable to illustrate certain characteristics of the male and the female genital organs and of the fifth abdominal sternum of the male. This is done in the following brief explanation of the anatomy of the male copulatory appendages and of the ovipositor, the remarks being based on the structure of those parts as they appear in *Hy'emyia cilicrura* Rond.

MALE COPULATORY APPENDAGES

The male copulatory appendages may be divided arbitrarily into four groups, as follows: (1) the cerci, (2) the genital styles (gonostyli), (3) the genital pouch (in which the genital appendages are situated), and (4) the processes of the fifth abdominal sternum.

The cerci

The cerci *sens lato* (forceps superiores) represent the paired appendages of the atrophied eleventh segment. They appear typically as flattened plates caudad of the anus and between the bases of the dististyli (forceps inferiores). Morphologists are still uncertain whether these fused plates represent the true limbs or rami of the appendages of the eleventh segment — that is, the cerci *sens strat.* — or merely the basal plates or paraprocts of such appendages. Such plates are always closely associated with one another, whether completely fused along the mid line into one immovable piece — as, for example, in *Hylemyia cilicrura*, *Hammomyia* spp., *Hydrophoria* spp., and others — or remaining semi-detached as two interdependent plates, as in *Pegomyia calyptata*, *P. fuscofasciata*, *P. bicolor*, *Eustalomyia* spp., and others.

Each cercus becomes closely associated with its respective dististylus, whether by direct fusion in thin chitinous sheets or by an articulatory mechanism in which a projection of the cercus fits into the complementary socket of the dististylus beneath (Plate I, c). The shape of the cerci, where seen from above, is of considerable taxonomic importance; their forms are so diversified, and, in the more important specimens, so indescribable, that only illustrations can satisfactorily indicate the significant characters. In certain cases the cerci possess accessory characters, such as the horn-like apical processes of *Hylemyia trivittata*, or the prong-like structures of *H. betarum*, *H. inornata*, *H. setigera*, and others. The armature of the cerci is invariably composed of bristles, setae, and hairs, arranged in various ways. The bristles arranged along the margin of the cerci are usually the stronger and longer; those on the inner areas are

weaker and hair-like. Apical tufts occur in *Hydrophoria uniformis*, *Pegomyia luteola*, and *Anthomyia pluvialis*. In *Hylemyia innocua* the marginal bristles are exceptionally long, and describe a delicate curl toward the tips. In what may be termed the "true" *Pegomyia* group,³ the bristles are invariably weak and sparsely distributed.

The genital styles (gonostyli)

The genital styles (gonostyli) represent a part of the paired appendages of the ninth abdominal segment. Each genital style is composed of two segments: the *basistylus*, or proximal segment (the tenth sternites of Metcalf, the pleural plates of Snodgrass); and the *dististylus*, or distal segment (forceps inferiores, styles). According to Crampton (1923), the tergal position of the genital styles in the higher Diptera, as compared with their sternal relationship in the lower Diptera, is due to a migration dorsad. The dististyli thus become fused with the caudoventral angles of the ninth tergum, immediately laterad of the cerci, and project typically as two bisymmetrical rami beyond the apex of the cerci. In *Pegomyia hyoscyami*, the dististyli are asymmetrical, the left process being longer than the right. Besides being adjusted to the movements of the cerci, the dististyli articulate, through the medium of a basal process, with the caudal extremity of their respective basistyli.

The dististyli vary considerably in form and appearance among the genera and among the species. The innumerable shapes can best be described and compared by referring to the illustrations. Only in *Hydrophoria* might such a character be called generic in distinction. In the species represented in New York, as *Hydrophoria ambigua*, *H. uniformis*, *H. divisa*, and *H. flavohalterata*, the dististyli are elbowed at the middle in a caudal (posterior) direction. In the "true" *Pegomyia* group (excepting *hyoscyami*), the dististyli are short and stout, with the inner surface considerably notched and irregular in outline. In a group in which the species closely resemble one another, as *Hy'emyia inornata*, *H. setigera*, *H. piloseta*, *H. marginella*, and *H. marginata* (Malloch, 1918 d, plate 17), the delicate excisions of the inner surface are of considerable taxonomic importance in differentiating species.

The surface of the dististyli may be expanded, contracted, furrowed, excavated, or ridged in different ways. The integument may possess minute or longish hairs, tubercles, or teeth, frequently bunched and arranged in a significant manner, as, for example, in *Pegomyia juvenilis* and *Hylemyia depressa*.

The basistyli occur typically as two lateral chitinous strips situated on the membrane of the genital pouch, mesad of the lateral borders of the ninth tergum. Their direction may be modified so that they tend

³ Comprising the species *rubivora*, *vanduzeei*, *hyoscyami*, *fuscofasciata*, *calyptata*, *bicolor*, and *winthemi* of the genus *Pegomyia*, and *trivittata* of the genus *Hylemyia*.

to approximate caudad, whence they articulate with the basal process of their respective dististyli. The basistyli articulate cephalad with the lateral expansions of the basal rim of the penis sheath, as in *Pegomyia rubivora*, *P. connexa*, *P. lipsia*, *P. winthemi*, *P. luteola*, and others, or coalesce with and strengthen the rim itself, as in *Hylemyia cilicrura*, *H. antiqua*, *H. trichodactyla*, *Hydrophoria* spp., *Egle* spp., and others (Plate I, c). In *Pegomyia juvenilis* each basistylus seems to have divided longitudinally into two, so that each rod serves to connect an upper articulation of the dististylus with the lower articulation of the basal rim of the penis sheath, and a lower articulation of the dististylus with the upper articulation of the basal rim of the penis sheath.

The genital pouch

The genital pouch is that region which forms the floor, or ventral surface, of the hypopygium, and over which the cerci and the dististyli fold like the blade of a knife. The cephalic region of the pouch is bounded by the semicircular, strap-like, sixth sternum. Situated in the pouch is a group of small chitinous appendages, known as the penis (oedagus), which guide and direct the successful act of copulation. Metcalf (1921), in his excellent paper on the male genitalia of the Syrphidae, has fully described and identified these appendages. The structures there shown are in principle the same as those found in this subfamily, and Metcalf's nomenclature has been followed.

The penis, therefore may be divided into two systems as follows:

- I. The peripheral system:
 - a. The penis sheath.
- II. The axial system:
 - a. The chitinous box.
 - b. The ejaculatory hood.
 - c. The ejaculatory process.
 - d. The sustentacular apodeme.
 - e. The internal lobes:
 1. The caudal pair.
 2. The cephalic pair.

The peripheral system of the penis

The penis sheath.—The penis sheath is much reduced and is largely represented by the stout, heavily chitinized, basal rim, which appears as an arched plate defining the cephalic limit of the axial system of the penis. At its lateral extremities the rim supports the cephaloventral processes of the ninth tergum, and thence it passes mesad to articulate with the basistyli; or it is reinforced throughout the greater part of its extent by a fusion with the basistyli. The basal rim is composed of two lateral pieces which come to meet and fuse cephalad in the midventral line. At this point there frequently appears a prolongation of the chitin along the midventral line, as in *Pegomyia juvenilis*, *Hylemyia alcatheae*, *H. laevis*, *Paregle*

radicum, and other species; or an invagination to form a flat, laterally compressed, rudder-like plate, as in *Hylemyia curvipes*, *H. brassicae*, *Pegomyia vanduzeei*, *P. luteola*, *P. winthemi*, and other species. At the lateral extremities of the basal rim, in the region of the cephaloventral angle of the ninth tergum, there sometimes arise arched chitinous lamellae that extend in a complementary manner to the penis sheath, partially or entirely encircling the caudal limits of the axial system of the penis; for example, in *Pegomyia bicolor*, *P. fuscofasciata*, *P. connexa*, *P. luteola*, *Hylemyia variata*, *Paregle cinerella*, and other species.

The penis sheath, when present, arises from the basal rim as a thin, arched plate, appearing like a cradle for the reception and protection of the genital appendages when retracted, as in *Hylemyia trichodactyla*, *H. alcatloe*, *H. laevis*, *H. inornata*, *Pegomyia affinis*, *Hammomyia* spp., and other species. The distal margin of the sheath varies in contour, usually protruding on each side to articulate with the lateral extremities of the cephalic pair of internal lobes of the genital appendages. Frequently the penis sheath is reduced to a thin, transverse, chitinous plate between the arms formed by the basal rim. (Plate I, B and C.)

The axial system of the penis

The chitinous box.—The chitinous box is located as a central pivot for the support and radiation of the other structures constituting the axial system of the penis. It is in reality a hollow channel, which is surrounded loosely by two convex chitinous plates and through which the ejaculatory duct passes. In *Pegomyia luteola* the box appears as a framework, with arms of reinforced chitin for the support of the ejaculatory hood and the caudal pair of internal lobes. (Plate I, A, B, and H.)

The ejaculatory hood.—The ejaculatory hood typically arises as a tubular process, in a median position on the dorsal surface of the chitinous box. It stands erect by means of a thinly chitinized supporting membrane and bears at its apex a small membranous swelling or inflation. In many species (for example, *Pegomyia luteola* and *Hylemyia trivittata*), membranous folds or "ears" are developed laterad. In *Anthomyia pluvialis* the folds are large, and tend to obscure the central axis or process. In *Pegomyia rubivora* the ejaculatory hood appears slender and flexible, and is supported at its base by a chitinous sheath of the chitinous box. (Plate I, A, B, and H.)

The ejaculatory process.—The free, terminal appendage of the axial system of the penis is the ejaculatory process. It arises in close apposition to the caudal limits of the chitinous box, and continues the protective channel for the ejaculatory duct which has been partially formed by the chitinous box. In addition to this function, its purpose is to accentuate and bear the genital aperture. This orifice may be supported by a chitinous ring or capsule, as in *Pegomyia* spp., *Calythea albicincta*, and *Paregle cinerella*; or it may be surrounded by a frill of delicate, hyaline membrane. (Plate I, A, B, and I.) Both the shapes and the appearances of the ejaculatory

process are specifically different, and cannot be described for purposes of recognition. There are one or two "form-types" of this process that seem to have close affinities in certain species, but the conceptions of them are only relative, and there are many intergrading or questionable examples that detract from the possibility of making a systematic determination. In the following species the process seems to have a common characteristic appearance: *Hylemyia trichodactyla*, *H. curvipes*, *H. cilicrura*, *H. brassicae*, *H. antiqua*, *H. setitarsata*; and again, in *Pegomyia winthemi*, *P. vanduzeei*, *P. rubivora*, *P. fuscofasciata*, *P. calyptrata*, *P. affinis*, *P. bicolor*, and *P. geniculata*. In *Hylemyia inornata*, *H. setigera*, and *H. betarum*, the process is very much reduced; in *Pegomyia luteola* the surface is partially ornamented by black tubercles; in *Hylemyia pluvialis*, *H. testacea*, and *H. depressa*, the margins are serrated and toothed.

The sustentacular apodeme.—The sustentacular apodeme is a median, rod-like plate which articulates caudoventrad with the chitinous box. At the base of the apodeme there arises independently a broad, thin, transverse plate, which extends ventrad of the chitinous box and whose lateral margins partially envelop and support the plates of the box. The apodeme proper is composed of two closely fused chitinous plates, which assume their normal position within the body in the median plane. The apodeme may be compressed laterally or dorsoventrally in different degrees and proportions. In *Hylemyia cilicrura*, the apodeme plates become compressed laterally in the ental region as if for the attachment of directing muscles; in the ectal region the plates become compressed dorsoventrally as if for the articulation and leverage of the chitinous box. In *Pegomyia connexa*, the apodeme has become reduced to a slight transverse plate. (Plate I, A, B, F, and G.)

The internal lobes.—In the group here presented, the internal lobes comprise two pairs of chitinous structures which are arranged on either side of the chitinous box, in an oblique plane directed cephalad. Due to their comparative position, the lobes are conveniently designated as (1) the caudal, or inner, pair, and (2) the cephalic, or outer, pair. (Plate I, B.)

The caudal pair of internal lobes arise from the membrane of the genital pouch. These lobes vary enormously in specific shape and size. In many species they are erect, perpendicular appendages, as, for example, in *Pegomyia affinis*, *P. bicolor*, *Hylemyia betarum*, *Anthomyiella praticola*, and *Eustalomyia vittipes*; in other species they are decumbent, horizontal appendages, as in *Hylemyia trichodactyla*, *H. pluvialis*, *H. antiqua*, *H. brassicae*, and *H. cilicrura*. Distinctive forms are to be found in the species *Pegomyia luteola*, *P. rubivora*, *P. winthemi*, and *P. fuscofasciata*. Each lobe typically bears one or more bristles or tubercles on the anterior margin. In *Hylemyia setigera* and *H. inornata*, the setae resemble long, flexible lashes; in *Pegomyia geniculata* the bristles are sharply bent near the apex; in *P. luteola* the setae have the form of a ribband or flagellum;

in *P. rubivora* the blunt, stiff bristle is borne on a pronounced basal process. (Plate I, B and E.)

The cephalic pair of internal lobes also arise from the membrane of the genital pouch. Like the caudal pair, they vary enormously in specific shape and size. The lateral (outer) extremities of the appendages frequently articulate with the distal margin of the penis sheath. Each appendage, or lobe, is typically furrowed on the inner surface so as to form a distinct fold or ridge. Usually this division becomes more marked toward the apex. In *Pegomyia connexa*, *P. geniculata*, *P. rubivora*, *Hammomyia* spp., and other species, the division is so marked as almost to divide the appendage into two parts. In *Pegomyia winthemi* and *P. fuscofasciata*, the caudal margin bears a well-developed fold. In *Hylemyia trivittata*, *H. inornata*, *H. setigera*, and *H. betarum*, the two cephalic internal lobes are reduced to inconspicuous appendages. Typically each appendage bears two bristles on the apical region. In *Paregle cinerella* these bristles are borne on a small prominence on the inner surface; in *Hylemyia inornata* and *H. setigera*, the bristles are represented by long, flexible lashes. (Plate I, B and D.)

The membrane, which coordinates the positions of the parts forming the penis, and occupies the ventral surface, or floor, of segments 8 and 9, is mostly hyaline and flexible. Occasionally, as in *Hylemyia cilicrura*, there arise on each side what seem to be cushion-like swellings. In the mid line, dorsocaudad of the ejaculatory hood, the membrane may become more densely chitinized and extend on the surface as a thinly chitinized lamella. (Plate I, A and H.)

The processes of the fifth sternum

The processes of the fifth sternum represent paired chitinous plates modified to aid in the act of copulation. The outer surface is heavily chitinized; the inner surface is lined with a delicate membrane which, in certain species, is modified into swellings and chitinous folds covered with minute setulae or spinules, as in *Hylemyia arnolitra*, *H. variata*, *Pegomyia calyptrata*, *P. fuscofasciata*, *P. winthemi*, and *Hydrophoria ambigua*. Typically the processes assume the position and the form of two lateral ensheathing plates or guides, possessing many sensory hairs and bristles. The specific shapes of the processes, and the arrangement and appearance of the bristles and hairs, afford characters of considerable taxonomic importance. A knowledge of these can best be conveyed by illustrations, for example, *Hylemyia pluvialis*, *Pegomyia vanduzeei*, *Hydrophoria ambigua*, and *H. uniformis*. In many species (for example, *Paregle cinerella*, *Hylemyia coenosiaeformis*, *H. innocua*, *H. curvipes*, and *H. setitarsata*) each process may bear, near the apex, spines or stiff, stout setulae; or this region may be significantly devoid of any bristles or hairs, as in *Pegomyia bicolor*, *P. hyoscyami*, and *P. geniculata*. Stout basal spines

are characteristic of such closely allied species as *Hylemyia inornata*, *H. setigera*, *H. piloseta*, *H. marginata*, and *H. marginella*. The inner margin of each process may possess a charactersitic series or tuft of hairs or setulae, as in *Anthomyia pluvialis*, *Egle parva*, *Pegomyia juvenilis*, *P. luteola*, *P. rubivora*, *Hylemyia betarum*, and *Hydrophoria uniformis*; or, again, these surfaces may be devoid of such hairs, as in *Paregle cinerella*, *Pegomyia bicolor*, *Hylemyia alcathoe*, *H. cilicrura*, and *H. trichodactyla*.

THE OVIPOSITOR

The ovipositor represents the modified terminal segments, 6 + 7, 8, 9, and 10, of the abdomen (Plate I, J). Such designation of the segments is in accordance with the following assumptions: (1) that the abdomen proper (preabdomen) consists of segments 1 to 5, the first tergum having fused with the second; (2) that the occurrence of two pairs of spiracles on a single apparent segment indicates the identity of two fused segments; and (3) that the appendages of the ultimate segment represent the cerci.

The ovipositor may be divided arbitrarily into three component parts — the segments, the intersegments, and the cerci.

The segments

Each segment is composed of the reduced tergum and sternum of the abdomen, together with the lateral conjunctivae. The tergum and the sternum of segment 10 are modified to form the upper and lower lamellae at the anal opening, that is, the suranal and subanal plates. The degrees of chitinization of the plates vary considerably within a species and between species. Typically the tergum is divided along the mid-dorsal line into two lateral, more heavily chitinized tergites, which tend to fuse along the caudal margin. The sternum is represented by a single median plate except in segment 9, where it is typically divided into two sternites (except in *Pegomyia hyoscyami*). The caudolateral angles of the terga of segment 6 + 7 and segment 8 may become accentuated by a thinning of the chitin across those regions, so that chitinous areas become isolated and form accessory pieces, as in *Pegomyia unicolor*, *P. calyptrata*, *P. fuscofasciata*, *P. winthemi*, *P. connexa*, *Paregle radicum*, *Hylemyia lasciva*, *Neohylemyia mallochii*, and other species.

The spiracles of the ovipositor are reduced to two pairs which are found typically in the vicinity of the lateral margins of tergum 6 + 7. Frequently they are found close to each other at the caudolateral angles of the tergum, or in association with the accessory pieces, as, for example, in *Pegomyia luteola*, *P. fuscofasciata*, *Paregle radicum*, and *Hylemyia lasciva*. Occasionally the caudal pair of spiracles may appear on the membrane of intersegment 7, as in *Pegomyia hyoscyami* and *Hammomyia paludis*.

The armature of the segments is typically represented by bristles, spines, hairs, and setulae, either in a single or a scattered series or as a dense

tuft, as in *Pegomyia calyptrata*, *P. hyoscyami*, *P. fringilla*, and *P. vanduzeei*. Occasionally the bristles may be absent on certain parts, as in *Pegomyia calyptrata* and *P. affinis*. In still other species, as *Hylemyia setitarsata*, *Pegomyia lipsia*, *P. affinis*, and *Eremomyia vernalis*, the integument may be perfectly smooth; or it may be entirely spinulose, as in *Pegomyia ruficeps* and *P. calyptrata*. Frequently only certain terga or sterna (for example, in *Pegomyia unicolor*, *P. dissecta*, and *Hylemyia betarum*), or only certain parts of either sternum or tergum (as in *Pegomyia hyoscyami*, *P. littoralis*, *P. fringilla*, *Hylemyia fugax*, and *Hammomyia* spp.), may be covered with minute spinules. The ninth sternites of *Pegomyia winthemi* and *P. fuscofasciata* are clothed with fine, short hairs.

The lateral conjunctivae are extensive on all segments except the tenth, on which they have become unrecognizable as such due to the modification of the anal plates. The surface of the conjunctivae may be smooth, entirely spinulose, or partly smooth and partly spinulose, either collectively or individually. In this respect the membrane may conform to or be independent of the character of the tergum and the sternum immediately adjacent, as in *Hylemyia cilicrura*, *Pegomyia rubivora*, *Anthomyia pluvialis*, and other species. Frequently the conjunctival membrane may be roughened by tubercular thickenings or ridged lamellations of chitin, as in *Hylemyia lasciva* and *Paregle radicum*.

The intersegments

The intersegments are homologous to the transverse conjunctivae of the preabdomen. They are frequently equal in extent to the segments themselves, functioning as a membranous sheath for the inclusion of the segments when at rest, and acting as a telescopic extension for the lengthening of the ovipositor when in operation. In a few forms, notably among the leaf miners, the intersegments are reduced to narrow, transverse membranes, as in *Pegomyia calyptrata*, *P. vanduzeei*, *P. fringilla*, *P. hyoscyami*, and *P. ruficeps*. Intersegment 9 is reduced considerably in extent; on its ventral surface the membrane merges imperceptibly into that surrounding the genital opening.

The intersegmental membrane may be entirely smooth, as in *Pegomyia affinis*, *P. unicolor*, *Hylemyia innocua*, *H. setitarsata*, *Eremomyia vernalis*, and *Calythea albicincta*; or it may be entirely spinulose, as in *Pegomyia ruficeps*, *P. hyoscyami*, *P. fringilla*, *Hylemyia pluvialis*, *H. betarum*, and *H. cilicrura*; or it may be partly smooth and partly spinulose, as in *Pegomyia fuscofasciata*, *P. littoralis*, *P. winthemi*, *Hylemyia depressa*, and *Paregle radicum*, either collectively or individually. In certain species the spinules may overlap the adjacent membranes or sclerites, as in *Pegomyia winthemi*, *P. fuscofasciata*, *P. littoralis*, and *Hylemyia depressa*.

Like the conjunctivae, the intersegmental membrane may be roughened by chitinous granulations, which may or may not be spinulose, as in

Calythea albicincta and *Anthomyia pluvialis*. The spinules may differ in character and arrangement. Typically they are minute recurrent spinules, scattered densely on the membrane. Occasionally they are arranged regularly in transverse striae, as in *Egle muscaria*. In some species (as, for example, *Paregle radicum*, *P. cinerella*, *Anthomyiella praticola*, *Hylemyia lasciva*, and *Pegomyia luteola*), the spinules appear scale-like, resembling small, flattened, triangular plates. In *Pegomyia connexa*, intersegment 8 is armed with stout hooks as well as with spinules.

In the genera *Hammomyia*, *Hydrophoria*, and *Neohylemyia*, the dorsal and ventral regions are developed unequally, so that there is a considerable buckling or overlapping of the segments with the intersegments. This causes the ovipositor, when extended, to form a sharp curve, or arc, in a downward direction.

The cerci

The cerci form the paired anal appendages which arise laterad of the anal opening. (The anus is assumed to have come to lie within the tenth segment, due to the atrophy of the eleventh.) In appearance the cerci resemble palpus-like or club-shaped appendages. In reality they are hollow conical or saucer-shaped plates, the inner surface of which is lined with a delicate membrane. The proximal region has become considerably attenuated, so that in certain species it appears like a petiole, or stem, of attachment.

The armature of the cerci is typically composed of setae and hairs. In addition, minute sense organs with trigger-like papillae are to be found near the apex of each cercus. In the genera *Hammomyia*, *Hydrophoria*, and *Neohylemyia*, stout curved spines are present on the cerci, besides the normal setae.

The integument of the cerci, like that of the segments and the intersegments, may be spinulose, as in *Hammomyia* spp., *Neohylemyia* spp., and *Hylemyia variata*; or it may be smooth, as in *Pegomyia calyptrata*, *P. hyoscyami*, and *P. ruficeps*.

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*The numbering of the figures on Plates VII, VIII, and IX of the publication here cited is erroneous. Schnabl's correction of these, afforded by the copy of Dr. J. M. Aldrich, is as follows; the corrected number follows that of the printed error.

On Plates VII and VIII, figure 4 should be numbered 3; 5, 4; 7, 5; 8, 6; 10, 7; 11, 8; 13, 9; 14, 10; 16, 11; 19, 13; 22, 15; 23, 16; 26, 17; 27, 18; 29, 21; 30, 22; 32, 19; 33, 20; 35, 23; 36, 24; 38, 25; 39, 26; 41, 27; 42, 28; 44, 29; 45, 30; 47, 31; 48, 32.

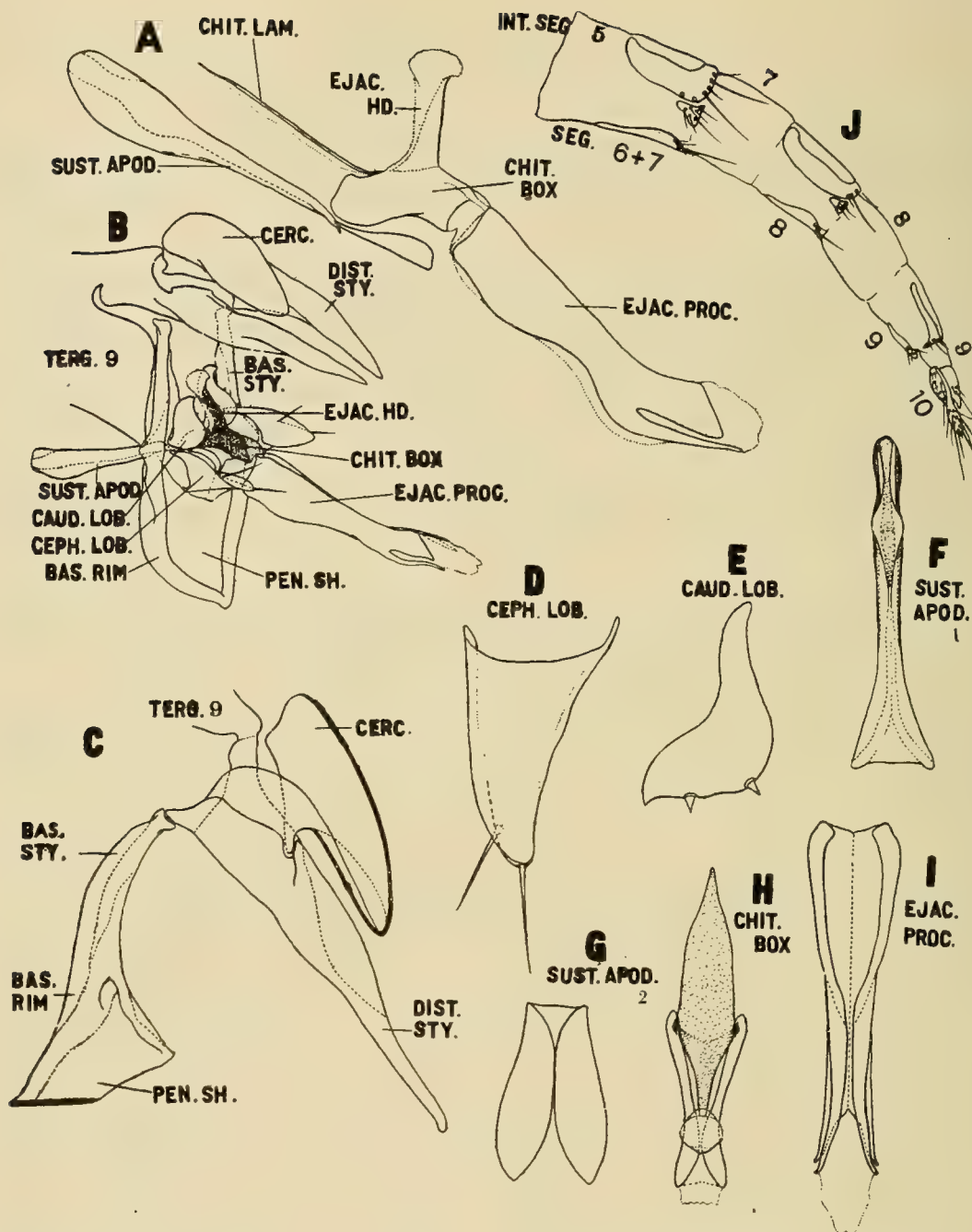
On Plate IX, figure 3 should be numbered 33; 6, 34; 9, 35; 12, 35; 15, 36; 18, 37; 21, 38; 24, 39; 25, 39; 28, 41; 31, 43; 34, 42; 37, 44; 40, 45; 43, 46; 46, 47; 49, 48.

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ANATOMY OF THE MALE AND FEMALE GENITALIA, ACCORDING TO *HYLEMYIA CILICRURA*
RONDANI

A, Lateral aspect of parts forming median axis of axial system of penis. B, Lateroventral aspect of male copulatory appendages. C, Sagittal section through cerci and penis sheath, and between gonostyli. D, Lateral aspect of a cephalic lobe. E, Lateral aspect of a caudal lobe. F, Dorsal aspect of sustentacular apodeme. G, Ventral aspect of prolongation (supporting appendage) of sustentacular apodeme. H, Dorsal aspect of chitinous box, showing the superimposed position of chitinous lamella and ejaculatory hood. I, Ventral aspect of ejaculatory process. J, Lateral aspect of ovipositor, showing the numbering of segments and intersegments

KEY TO ABBREVIATIONS USED ON PLATE

Bas. rim = basal rim
Bas. sty. = basistylus
Caud. lob. = caudal lobe
Ceph. lob. = cephalic lobe
Cerc. = cerci

Chit. box = chitinous box
Chit. lam. = chitinous lamella
Dist. sty. = dististylus
Ejac. hd. = ejaculatory hood
Ejac. proc. = ejaculatory process

Int. seg. = intersegment
Pen. sh. = penis sheath
Seg. = segment
Sust. apod. = sustentacular apodeme
Terg. 9 = tergum 9



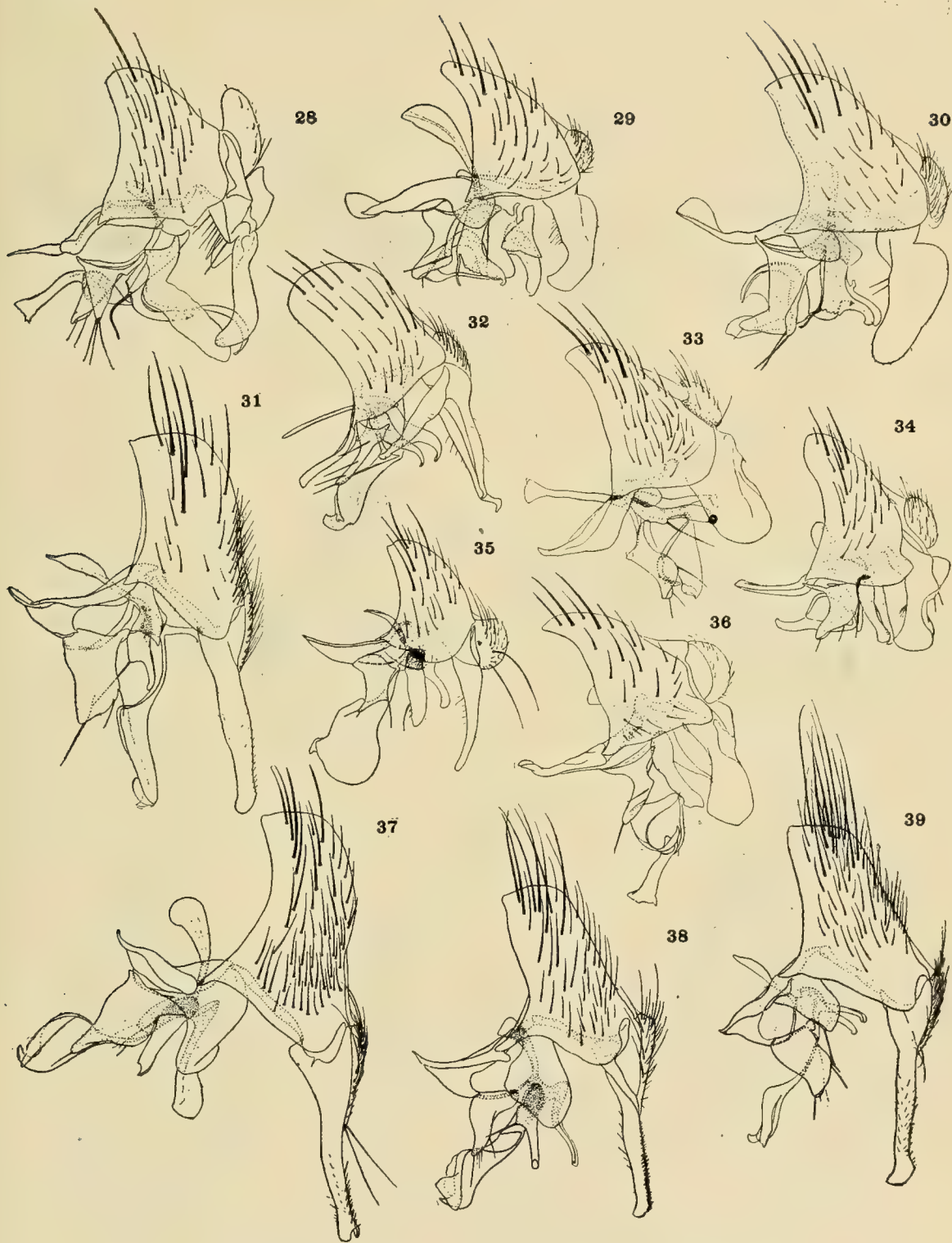
LATERAL ASPECT OF MALE COPULATORY APPENDAGES

- 1, *Hylemyia antiqua*. 2, *H. brassicae*. 3, *H. trichodactyla*. 4, *H. cilicrura*. 5, *H. innocua*. 6, *H. curvipes*. 7, *H. ithacensis*. 8, *H. setitarsata*. 9, *H. coenosiaeformis*. 10, *H. lasciva*. 11, *H. setigera*. 12, *H. betarum*. 13, *H. inornata*



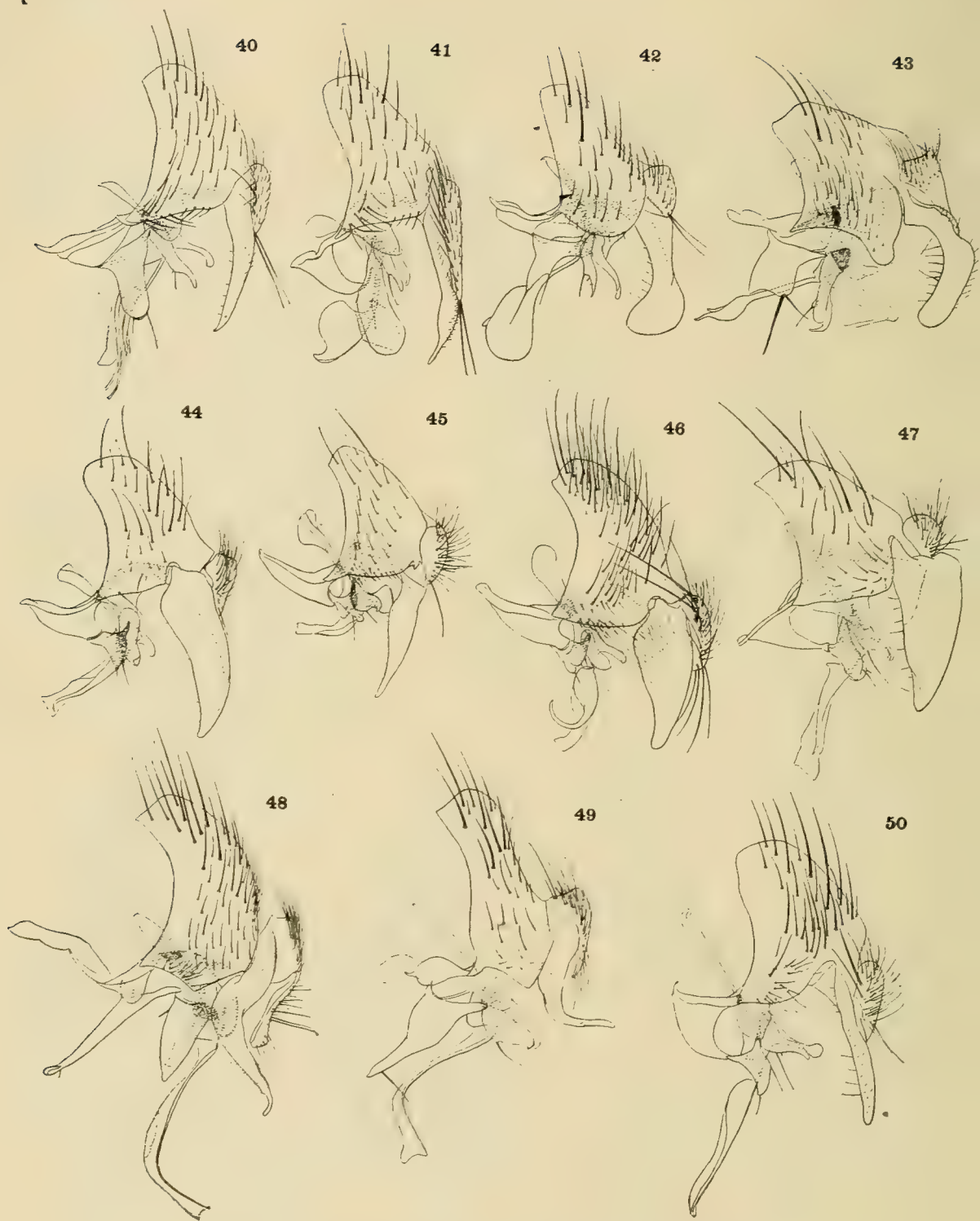
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- 14, *Hylemyia alcaethoe*. 15, *H. laevis*. 16, *H. arnolitra*. 17, *H. variata*. 18, *H. trivittata*.
 19, *H. pluvialis*. 20, *H. depressa*, *H. testacea*
 21, *Pegomyia luteola*. 22, *P. lipsia*. 23, *P. dissecta*. 24, *P. affinis*. 25, *P. geniculata*.
 26, *P. connexa*. 27, *P. juvenilis*



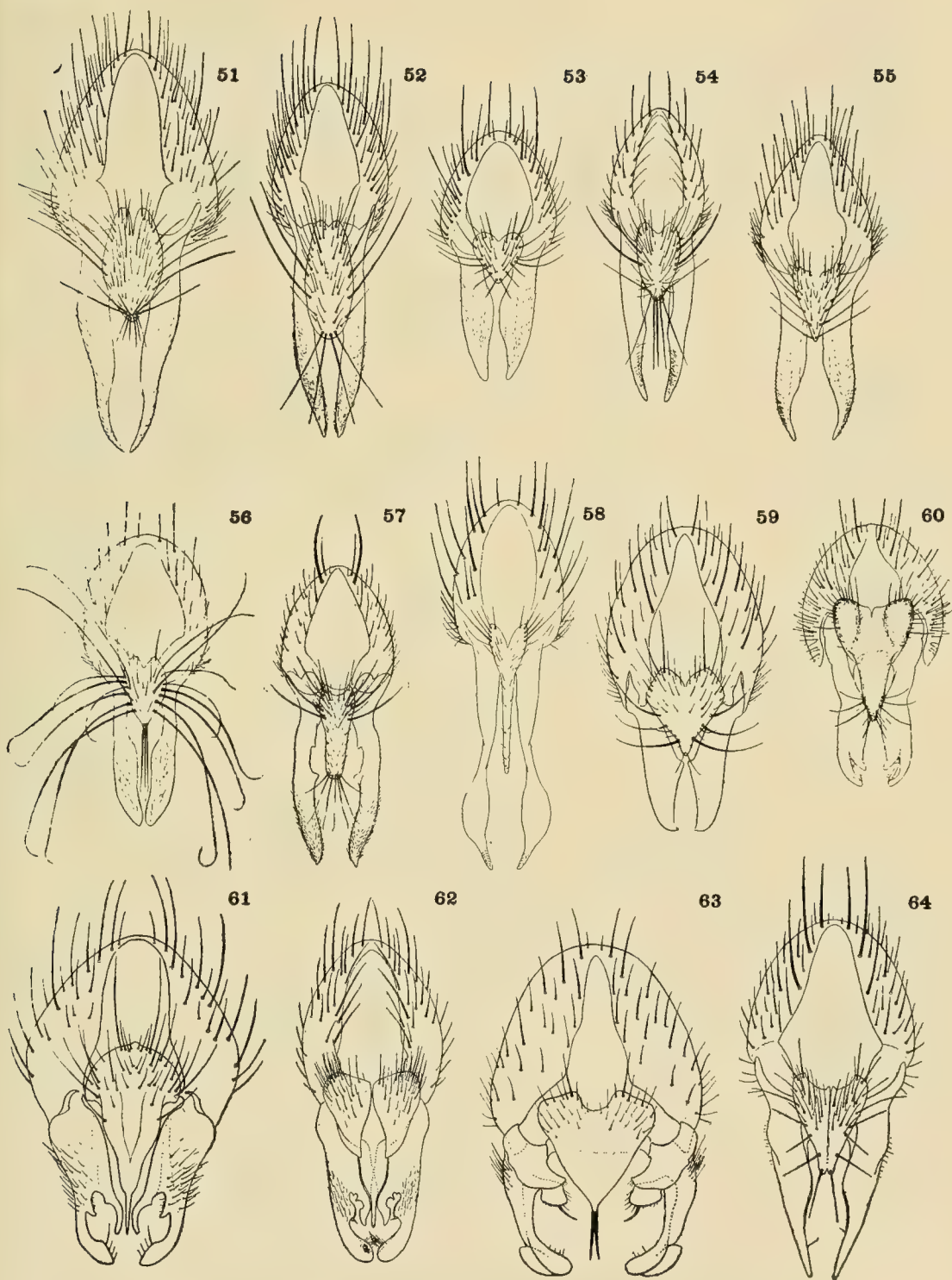
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- 28, *Pegomyia rubivora*. 29, *P. fuscofasciata*. 30, *P. winthemi*.
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 37, *Eremomyia vernalis*. 38, *E. humeralis*.
 39, *Eremomyoides fuscipes*, *E. similis*.



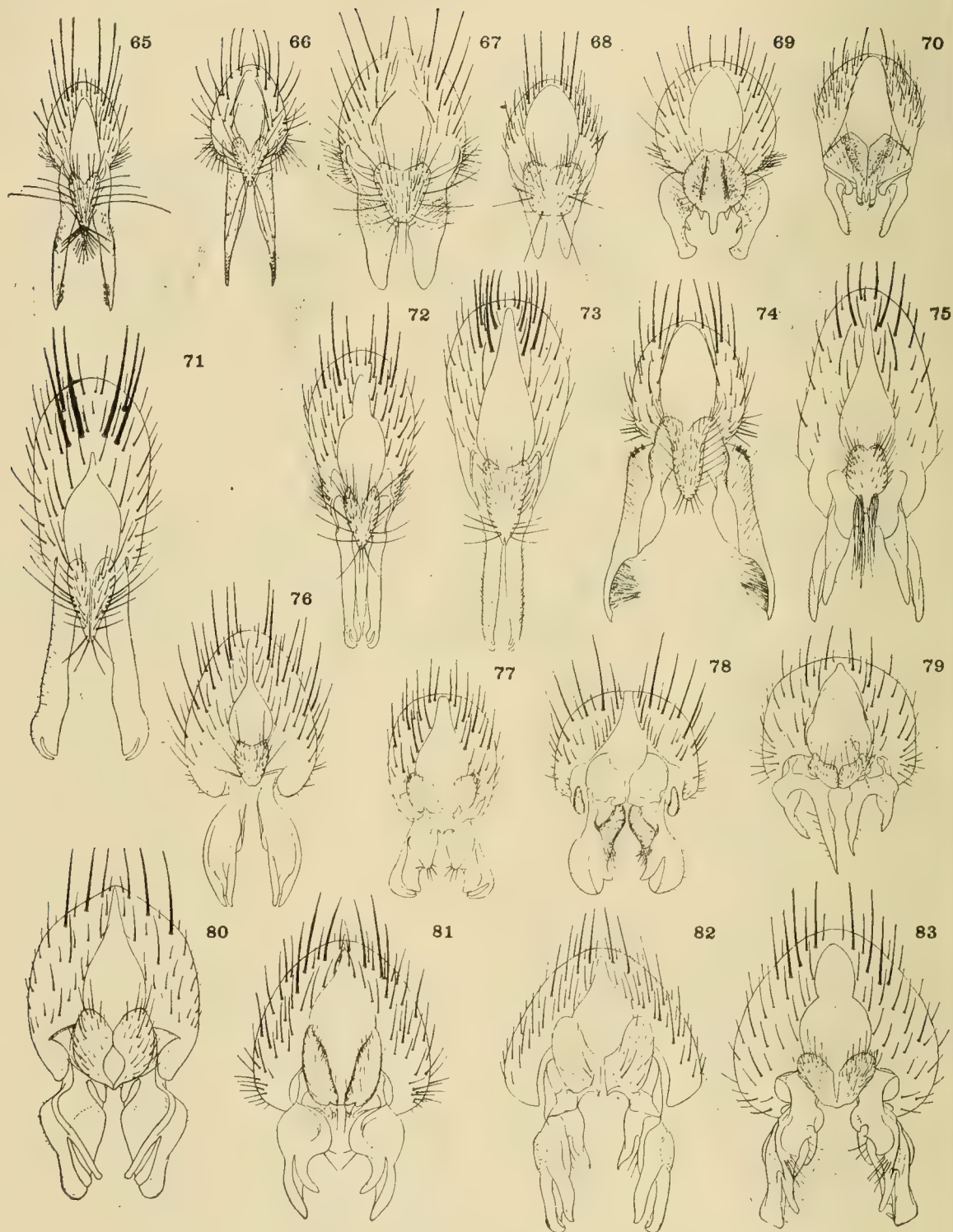
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- 40, *Paregle radicum*. 41, *P. cinerella*
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 43, *Anthomyia pluvialis*
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 47, *Eustalomyia vittipes*
 48, *Hydrophoria ambigua*. 49, *H. uniformis*
 50, *Neohylemyia mallochii*



DORSAL (OR CAUDAL) ASPECT OF CERCI, GONOSTYLI, AND TERGUM 9

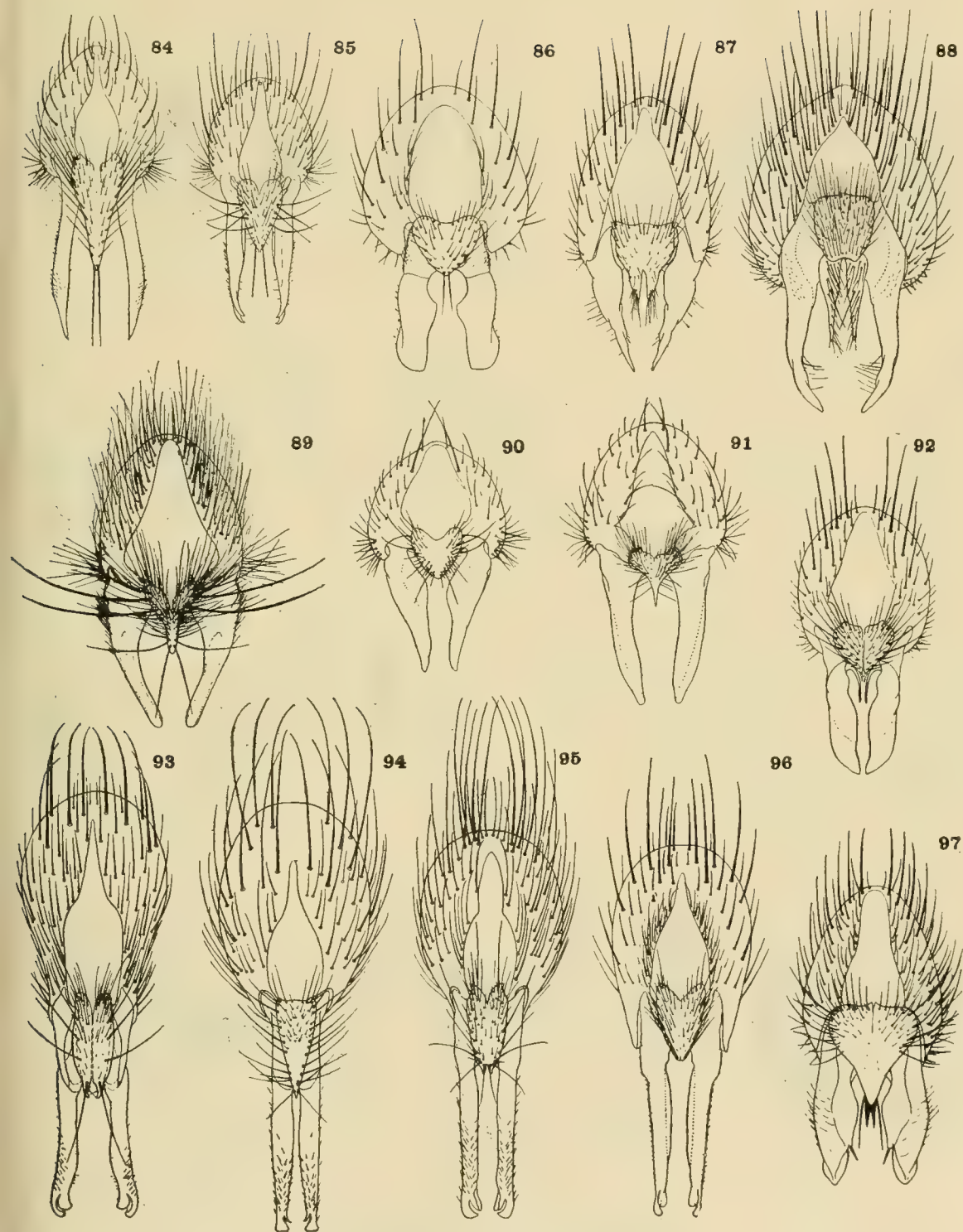
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DORSAL (OR CAUDAL) ASPECT OF CERCI, GONOSTYLI, AND TERGUM 9

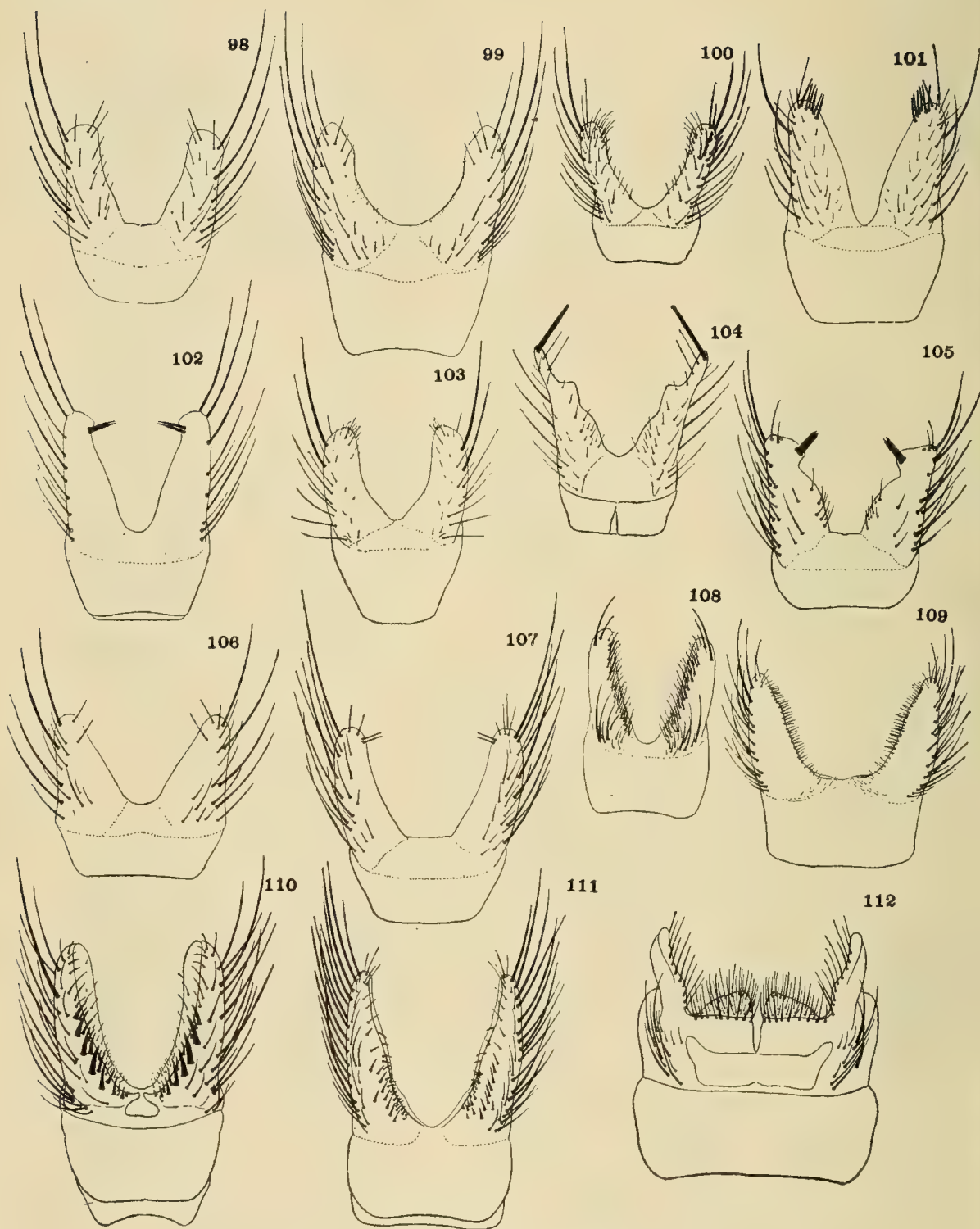
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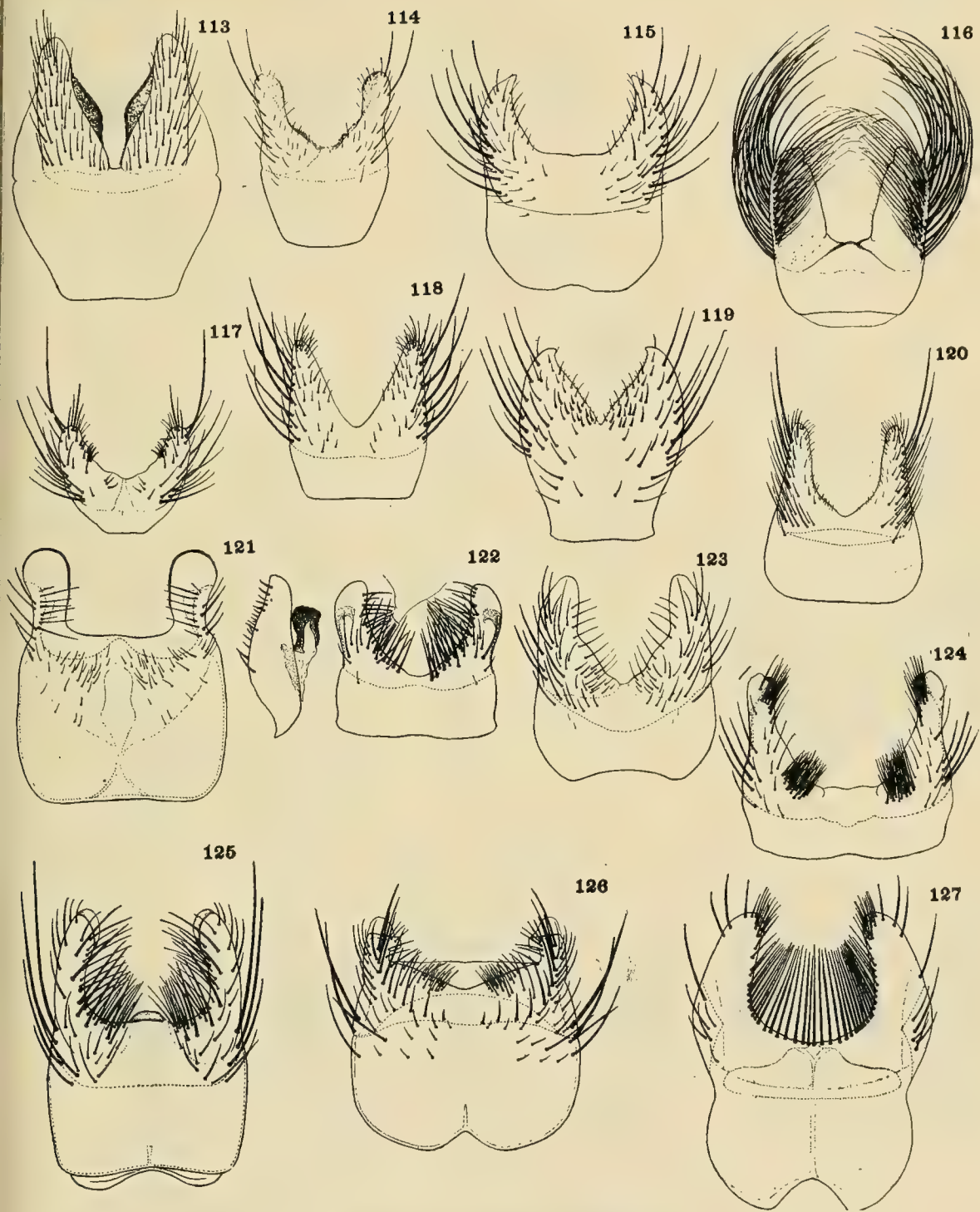
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- 84, *Paregle cinerella*. 85, *P. radicum*
 86, *Calythea albicincta* :
 87, *Hydrophoria uniformis*. 88, *H. ambigua*
 89, *Hammomyia unilineata*. 90, *H. johnsoni*. 91, *H. paludis*
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VENTRAL ASPECT OF STERNUM 5

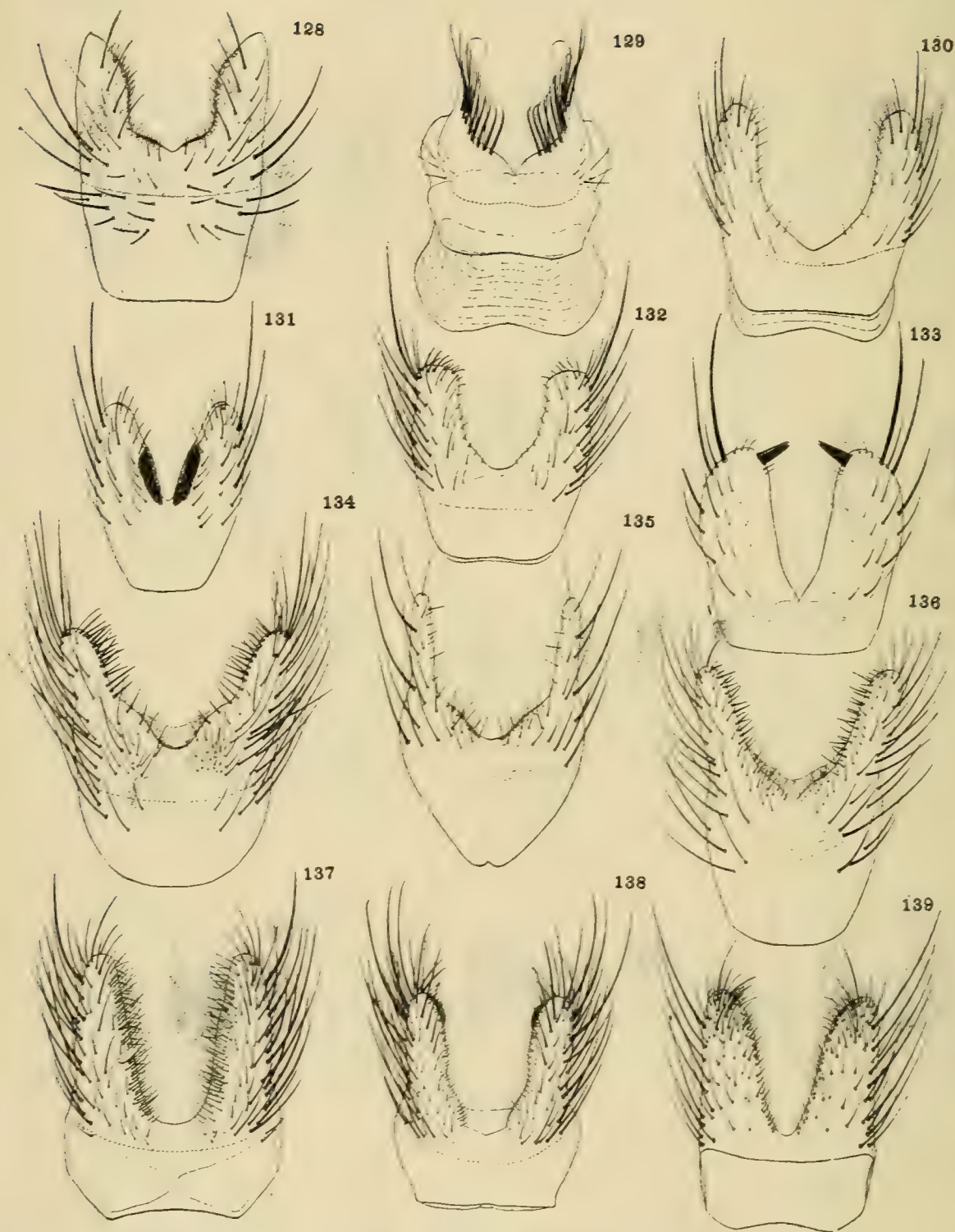
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VENTRAL ASPECT OF STERNUM 5

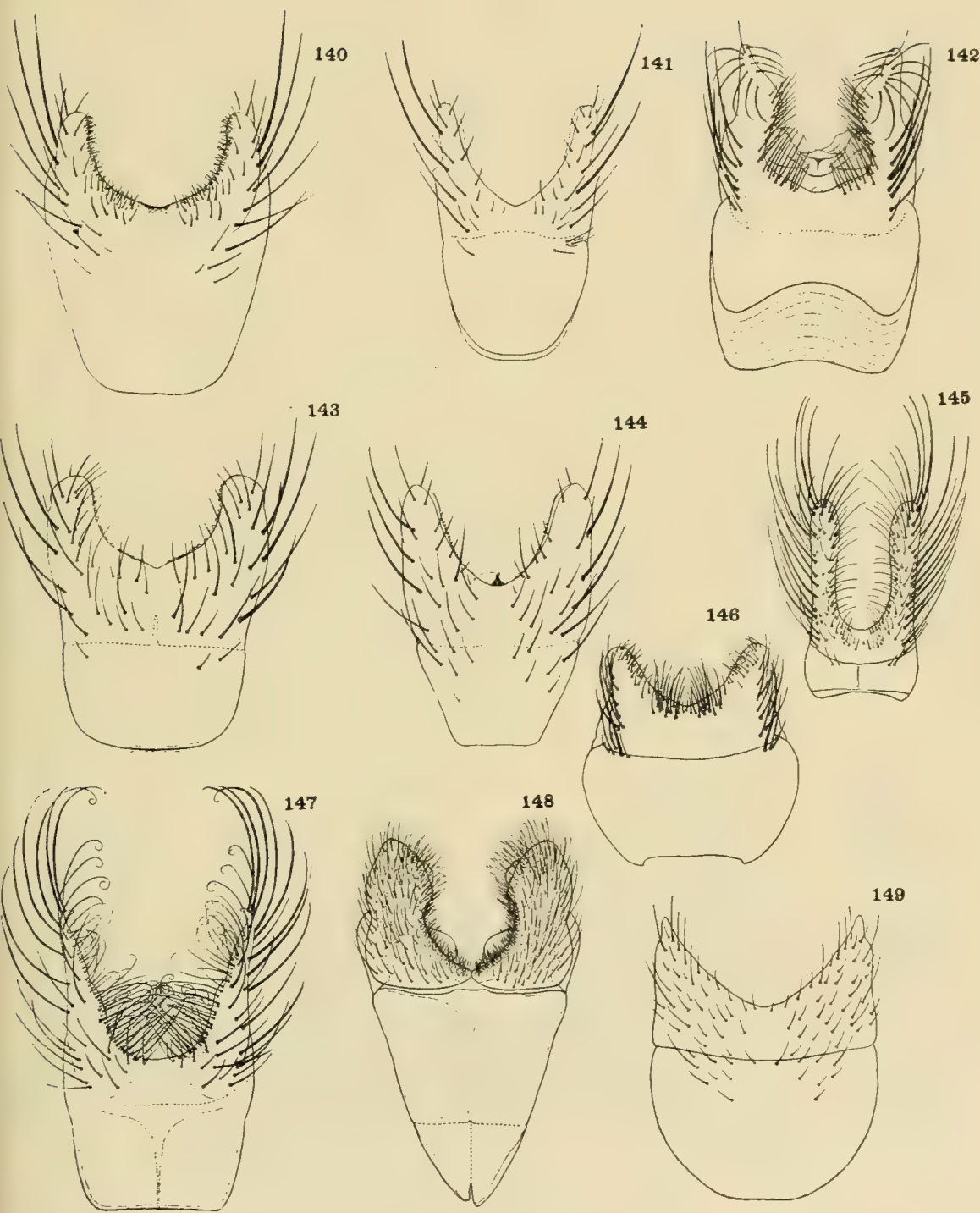
113, *Hylemyia arnolitra*. 114, *H. variata*. 115, *H. lasciva*. 116, *H. pluvialis*. 117, *H. laevis*

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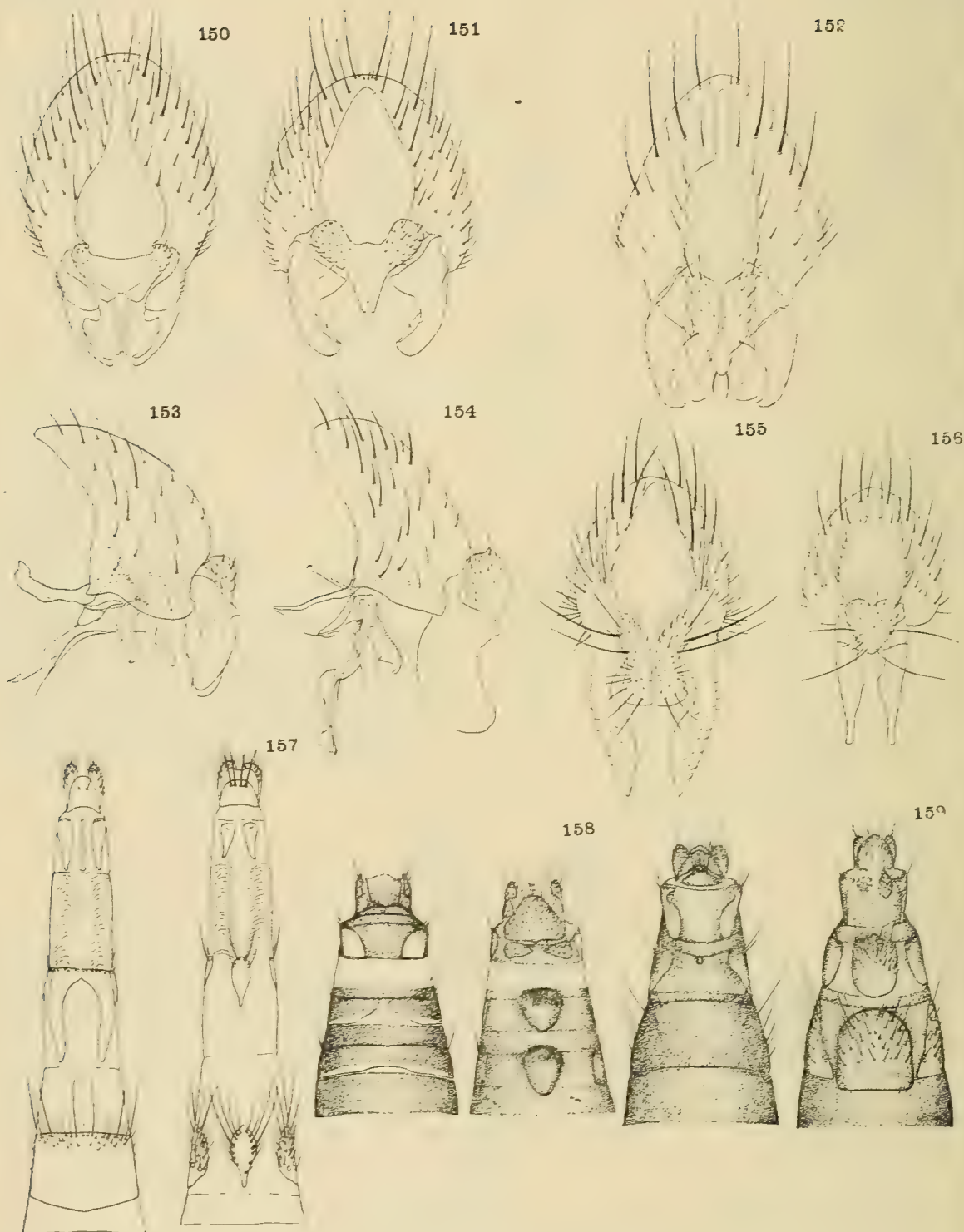
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- 128, *Pegomyia geniculata*. 129, *P. luteola*. 130, *P. connexa*. 131, *P. juvenilis*
 132, *Paregle radicum*. 133, *P. cinerella*
 134, *Hammomyia unilineata*. 135, *H. johnsoni*. 136, *H. paludis*
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 139, *Eremomyoides fuscipes*, *E. similis*



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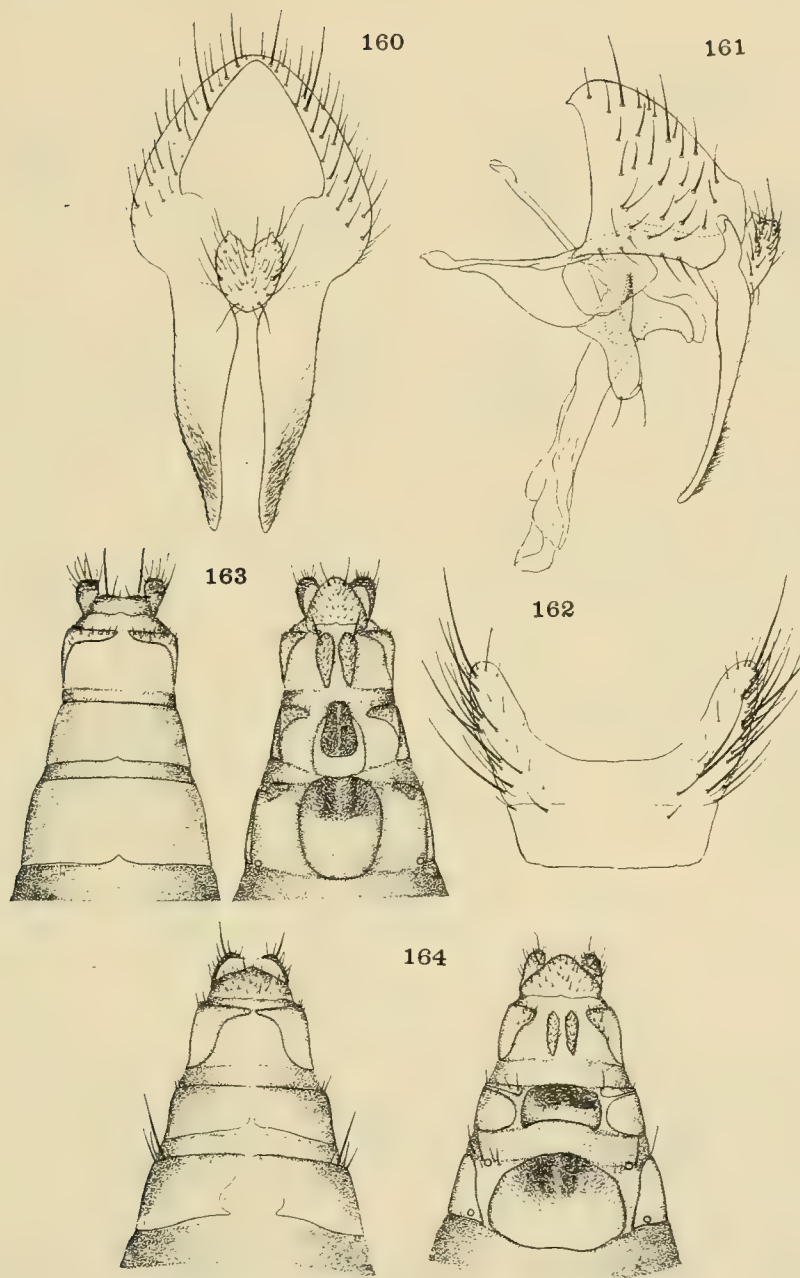


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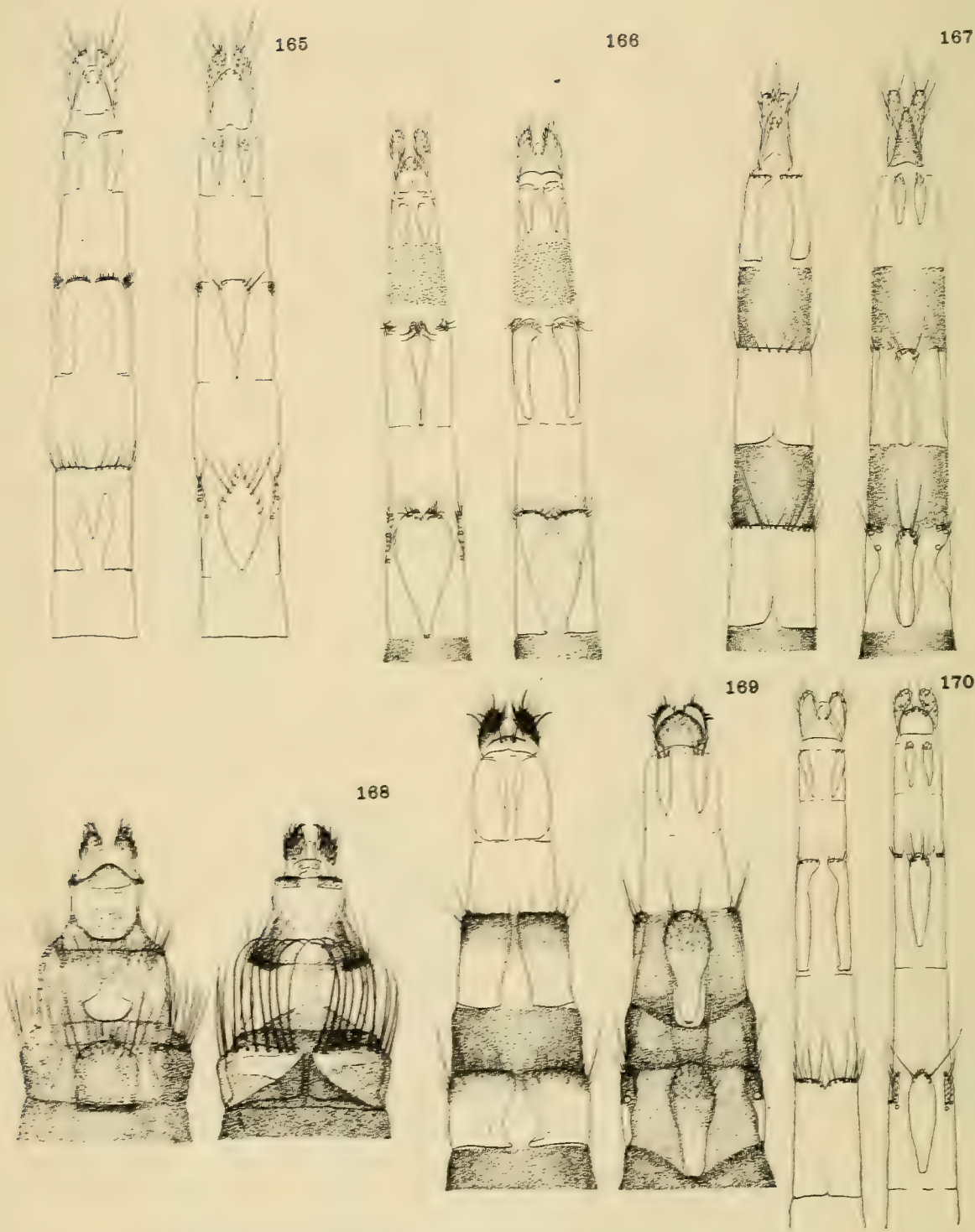
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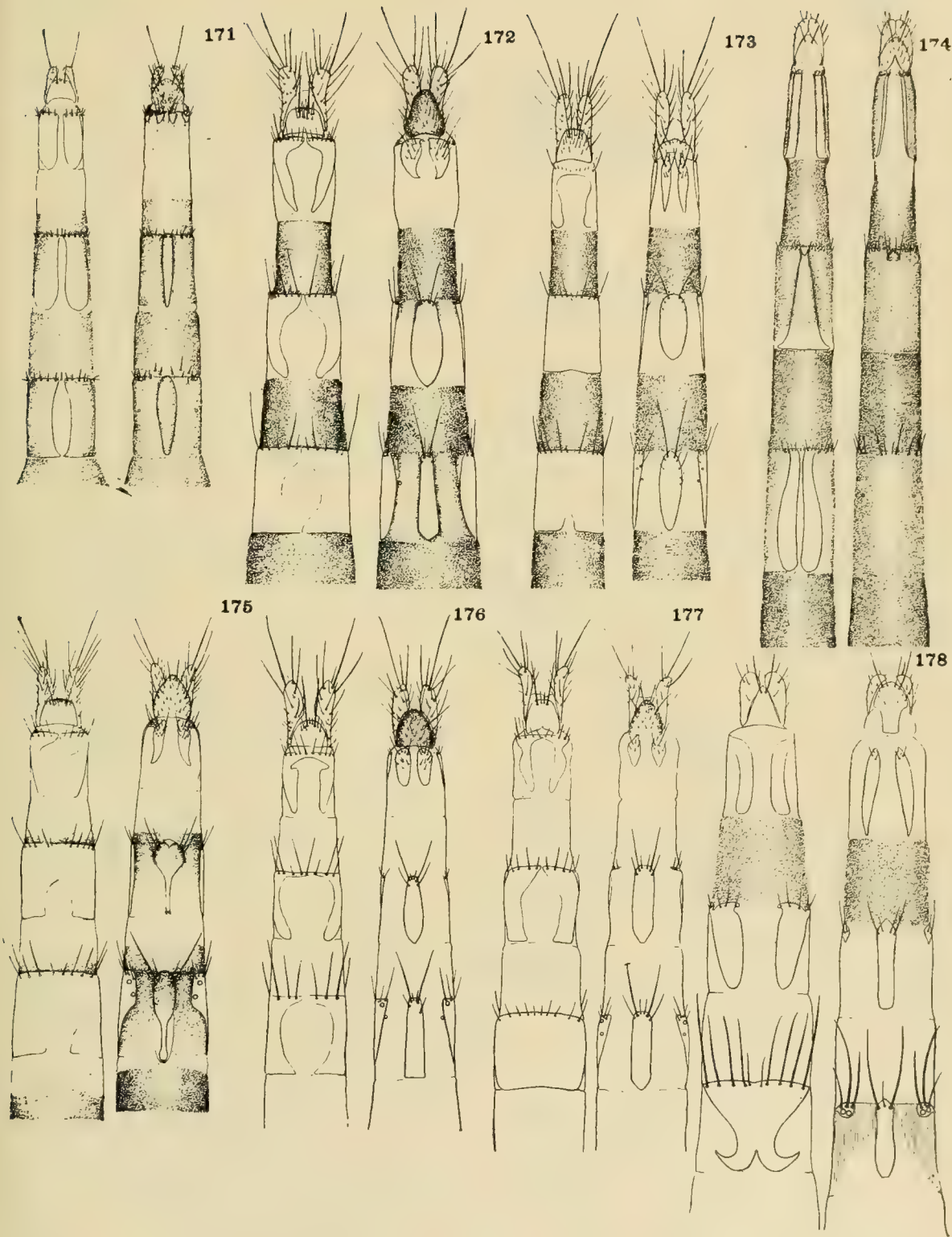
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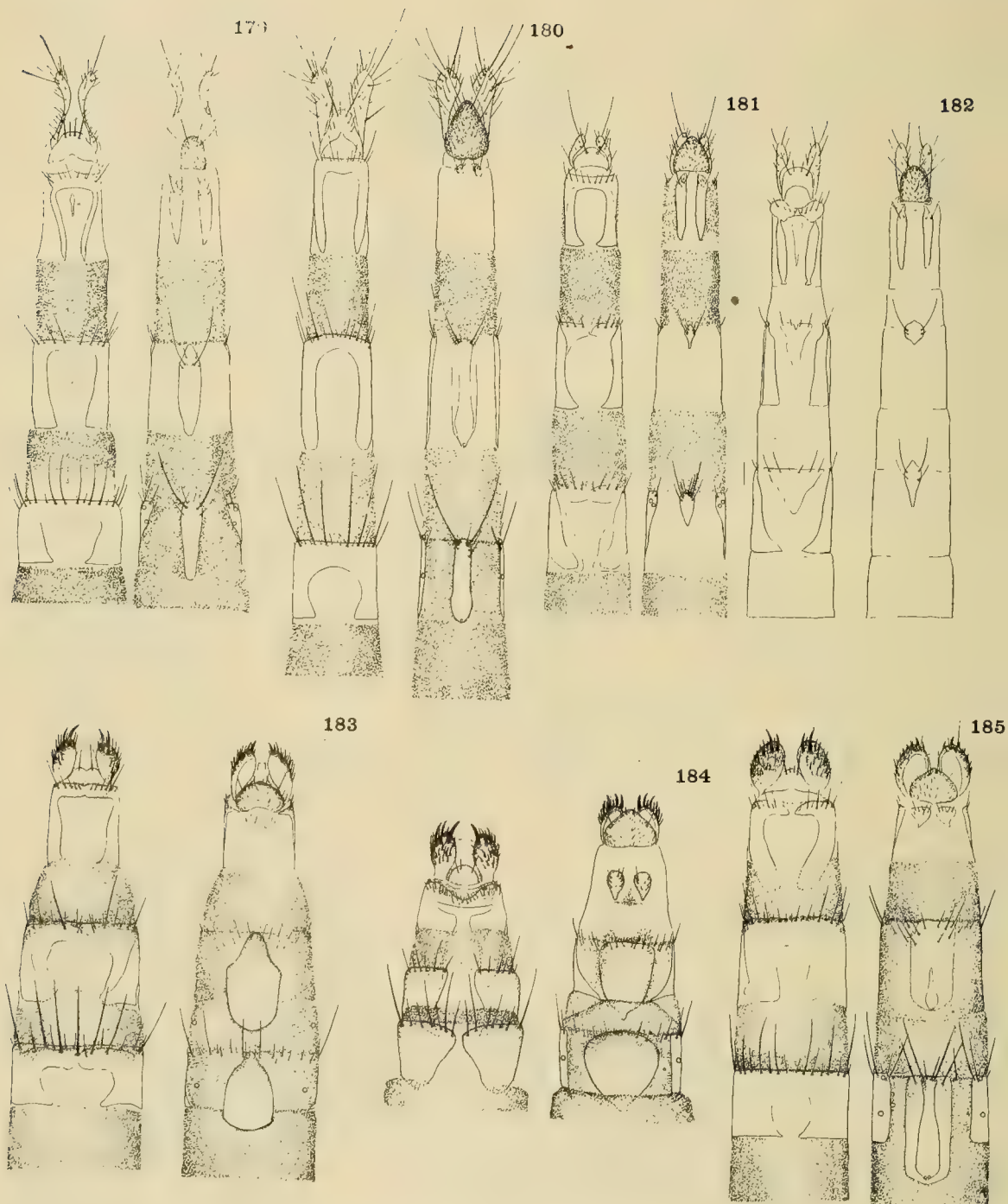
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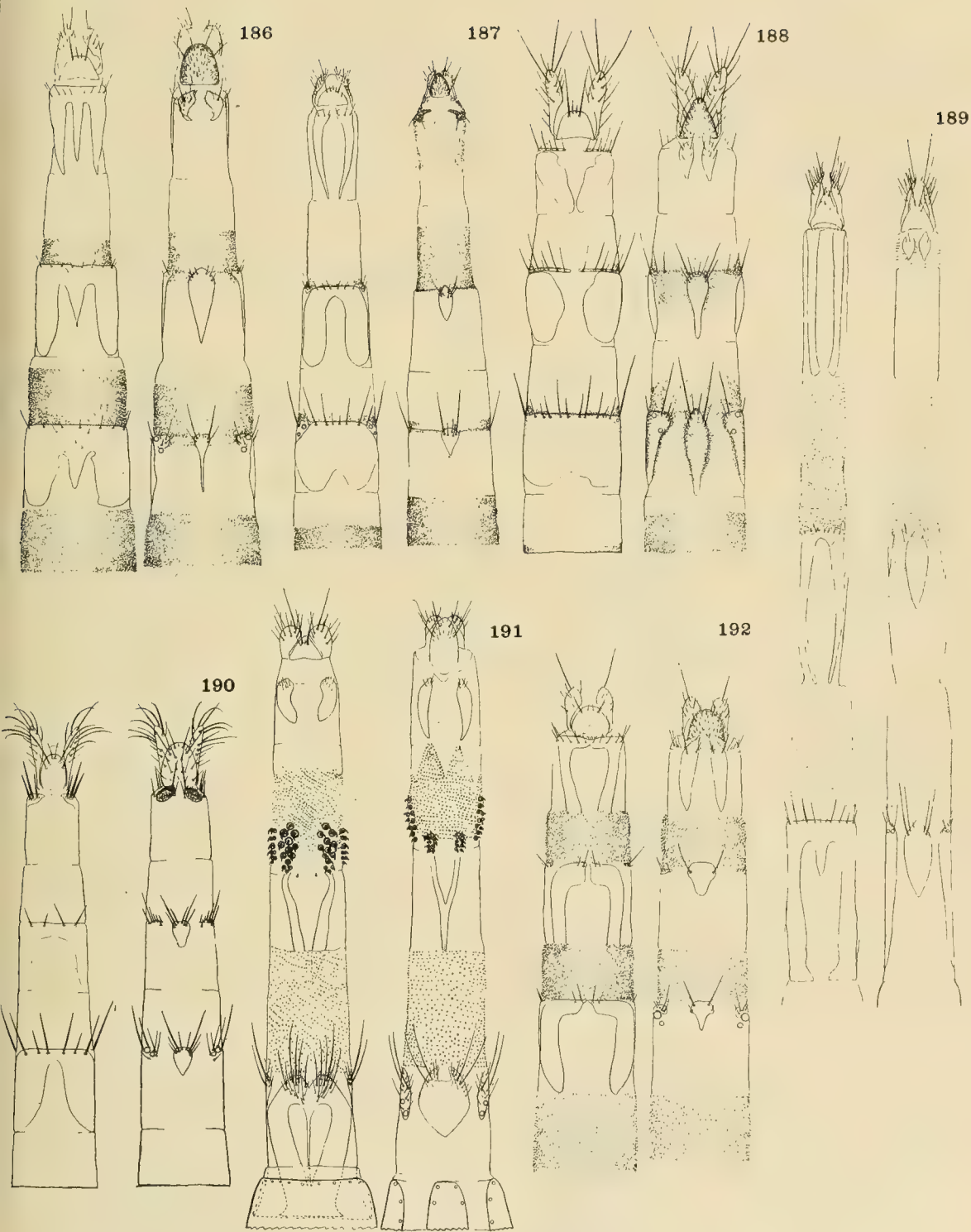
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